Bell Telephone

Operator Toll Dialing—The Coming Way
RALPH I. MABBS

The International Telecommunication Conference of 1947 • BARTLETT T. MILLER

"Arms of the Law"—Police Communications
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The Biggest Offer Ever • FREDERICK A. WISEMAN

Bell Telephone Magazine

Winter 1947-48

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A Medium of Suggestion & a Record of Progress

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WALTER S. GIFFORD, *Pres.;* CARROLL O. BICKELHAUPT, *Sec.;* DONALD R. BELCHER, *Treas.*

Who's Who & What's What

in This Issue

FROM 1916 to 1922 RALPH I. MABBS held traffic posts with the Long Lines Department in cities of the southwest before he transferred to the O. & E. Department of the A. T. & T. Company. There he adapted the principles of trunking to the "coefficient" method of measuring operator work volumes which is now in use throughout the Bell System. In 1926 he entered traffic field work again, with the New York Telephone Company. Returning to the O. & E. Department in 1929, he has since been engineer, toll traffic engineer, traffic methods engineer, and, currently, traffic facilities engineer. To the Winter 1944–45 issue of this MAGAZINE he contributed his lucid explanation of "Providing Paths for Long Distance Calls."

A STATEMENT of the Bell System career of KEITH S. MCHUGH, A. T. & T. vice president in charge of Public Relations, was given in the Autumn issue, in which was published his inquiry into "How Big Are the Little Things in the Telephone Business?"

WHILE he was in general charge of the Bell System group attending the International Telecommunication Conference, and, indeed, while he was preparing this issue's description of what went on there, BARTLETT T. MILLER was an assistant vice president in the O. & E. Department of the A. T. & T. Company. Since January 1, 1948, he has been A. T. & T. vice president in charge of the Long Lines Department. His telephone career began in 1910, when he joined the Colorado Telephone Company. Traffic and Commercial work in the west and with the New England Telephone and Telegraph Company preceded his successive appointments with the latter company as vice president, Public Relations; vice president, Public Relations and Personnel; and vice president and general manager—the job he relinquished in 1946 to go to 195 Broadway.

JOINING THE Long Lines Department in New York in 1936, RICHARD B. HOLT had both Plant and Commercial experience before he was transferred to Washington,

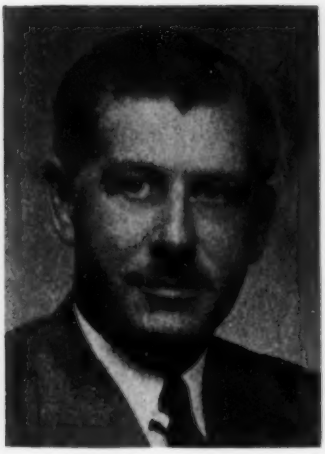
Ralph I. Mabbs

Keith S. McHugh

Bartlett T. Miller

Richard B. Holt

Timothy P. Mannix



Harry Jeavons

D. C. Here, during the war, he was engaged in servicing work for the Army's nation-wide communication networks—and received the Army's Certificate of Appreciation for it in 1946. In that year he transferred to the O. & E. Department's commercial division, where he has since been busy, in the sales and servicing section, with toll and private-line servicing activities.

WITH A BACKGROUND of newspaper work which included special feature, editorial, and political writing, TIMOTHY P. MANNIX joined the staff of *Telephone Topics*, the employee magazine of the New England Telephone and Telegraph Company, in Boston in 1942. He subsequently became its editor, and is now information supervisor of the company.

WITH THE Long Lines Department since 1913, HARRY JEAVONS was press service manager from 1929 to 1940. In the latter year he was made division commercial manager at Washington, D. C., and there he rendered service during the war to military and civilian agencies, in connection not only with their private-line service requirements but with their domestic and international communication networks. His Army Certificate of Appreciation was "for outstanding service through the establishment and maintenance of the national teletypewriter and telephone networks of the Signal Corps in record time." In 1945 Mr. Jeavons served as president of Alexander Graham Bell Chapter of the Telephone Pioneers of America. The illustrations which accompany his article are by courtesy of the U. S. Weather Bureau.

THE OPERATION which FREDERICK A. WISEMAN describes so vividly, he knows more than a little about. He has to: he was Security Issue manager. He has been since 1930 an A. T. & T. assistant treasurer, and since 1942 head of the financial di-

(Continued on page 252)

Frederick A. Wiseman

Installation of crossbar toll switching equipment in the Long Lines Department's headquarters building in New York—another step in the Bell System's operator toll dialing program. *See the article beginning on the opposite page*

A Program Is in Progress throughout the Industry Which Will Increase the Speed and Accuracy with Which Toll Calls Go Through to the Called Telephone

Nation-wide Operator Toll Dialing—the Coming Way

Ralph I. Mabbs

This is the text—with minor editorial revisions—of a talk which was given in Chicago on October 14, 1947, in connection with the Fiftieth Anniversary Meeting of the United States Independent Telephone Association—EDITOR.*

OPERATOR TOLL DIALING is a very promising development for toll telephone service.

Equipment that will do the job costs about the same as other types of dial equipment. Although not available in quantity now, it takes about the same time to manufacture and install. And once it is in, its effect on service is immediately noticeable. Those of you who have seen it are no doubt well aware of its greater speed in handling direct-circuit calls. You may have noticed, too, that switched calls may be put through almost as quickly as direct-circuit calls.

There were, of course, many engineering problems involved in the introduction of operator toll dialing. But most of them have been solved. The program is progressing satisfactorily on an industry-wide basis, and right now more than five percent of the country's traffic between toll centers is handled by this method. Once the material scarcities are overcome and enough time has elapsed to permit more of this equipment to be installed, telephone customers are going to be greatly pleased with the speed and accuracy with which their calls are handled.

Before discussing the operator toll dialing plan as it is now foreseen, I should like to take a moment or so here to review the steps in the present and familiar manual method of handling toll calls—the so-called ring-down method. I think it might help

* See also "A Dial Switching System for Toll Calls," MAGAZINE Winter 1943–44; "Operator Toll Dialing—A New Long Distance Method," MAGAZINE Summer 1945.

provide a good platform on which to make comparisons with the dialing method, and at the same time point up some of the objectives for toll dialing.

Steps in Handling Ring-down Toll Calls

LET US TAKE, first, the direct circuit call.

After the calling operator gets the call details, she asks the calling party to hold the line. She then determines the route to the called place. Usually, 85 or 95 percent of the time, she gets that information from the bulletin right in front of her. On the rest, she obtains the route from the route desk. The customer in either case is holding the line.

Here are the rest of the steps. She selects a circuit and rings. Then when the inward operator in the called office answers, the calling operator passes the called telephone number, or the name and address. And as you know, if the called telephone number is not known by the calling operator, and the inward operator cannot supply the number from memory or from a bulletin at her position, inward connects her to an information operator.

Now the inward operator secures the called line on a switching trunk, rings the called station, and reports to the calling operator if the called line is busy or does not answer. In the meantime, while the inward operator is ringing the called number, the outward operator is requesting the calling number and completing the ticket details.

If the called station answers and it is a station-to-station call, the operator starts timing the conversation, cuts herself out of the connection, and proceeds with other work. If it is a person-to-person call, of course, she first reaches the desired party. When the call is ended, the calling operator receives a signal by means of a switchboard lamp associated with the cord of that connection. She then stamps or times her ticket, releases the connection, and sends the ticket to the filing position.

That's the direct circuit call.

If the call is to a built-up point, the originating operator asks the operator at an intermediate office for a circuit to the called office. This operator then selects a circuit and rings the called office. And in those cases where there is more than one intermediate office, the calling operator reaches each of the intermediate offices in turn and obtains a circuit to the next point.

If a no-circuit condition exists at the originating office, the operator holds the calling party on the line for one minute while she attempts to obtain a free circuit on any authorized route. At the end of that minute, if no circuit can be obtained, the customer is given a report and released. The operator holds his line for ten minutes, and during that interval she makes further attempts to secure a circuit. If she cannot obtain a circuit within the ten minutes, she releases the calling line and sends the ticket to a delayed-call position, where further circuit attempts are made.

There is one more condition I'd like to mention: no circuit at an intermediate office. Circuits to intermediate offices are usually held for five minutes while the intermediate

operator attempts to secure one. If she cannot, she records a call order and the calling circuit is released. The intermediate operator continues in her attempts to secure a circuit to the called office and, when she does so, she connects the calling office with the next office.

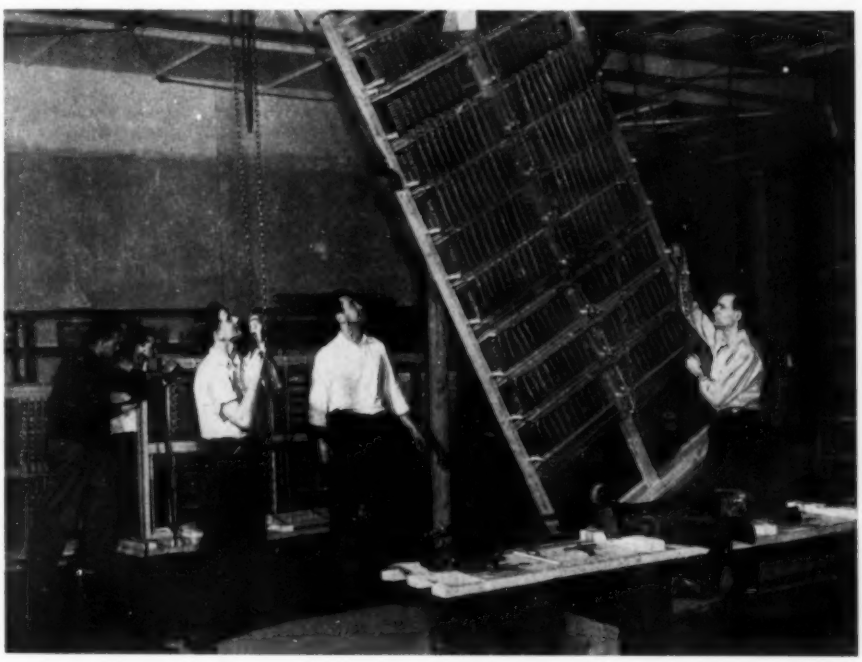
Ring-down Routing Plan

BEFORE we get into operator toll dialing, there is one other phase of ring-down operation I should like to point up: the routing of calls. To facilitate routing arrangements, toll centers are grouped into two classifications. Those designated as Class One are strategically located on main circuit routes. There are about 350 of these. The rest are grouped around these Class One offices, and are called Class Two.

In every Class One office, there is a simple route sheet which shows the route to every other Class One office, and many of these are direct routes between Class One toll centers. If you wanted to know the route to a most remote locality, all you'd have to know is the toll center and the Class One office through which it is reached. Both of these you could find in the Rate and Route Guide for every point.

Actually, in the day-to-day job you would need to refer to the Guide only rarely—on generally less than five percent of the calls. Routing bulletins, provided at each position, show all direct circuit points and as many of the others as can be usefully included. In addition there is a quick reference file at the Route Desk which lists additional places.

Percentage-wise, here is the way it breaks down:—



Erecting a crossbar frame in the Long Lines building in New York

The routing of 82 percent of long distance calls is direct. Frequently an alternative route is provided through an intermediate office.

Calls which go through one intermediate office are about 16 percent of the total, and there is often an alternative route through a different intermediate office.

The rest of the calls, less than two percent, require two or more switches. These usually involve far distant or very small places between which there is infrequent calling.

Circuit engineers and control bureaus constantly study the flow of traffic, and in order to maintain a balanced load on available circuit groups, routing arrangements undergo frequent change. Circuits are shifted from group to group. New direct circuit groups are created. And traffic is routed to other groups. To meet changes in traffic distribution between day and evening periods, for holidays, and as a result of out-of-order conditions, circuits are frequently shifted on short notice.

There are three ways in particular that operator toll dialing smooths the way for faster completion of calls:

1), Improvement in the speed with which the operator obtains the routing on a call;

2), Lamp signal supervision of the called station (i.e., visual indication that the called telephone has answered); and,

3), The elimination of delays at the intermediate toll centers on switched calls.

The first one, improvement in the speed with which routings are obtained, is brought about by the nation-wide numbering plan.

Nation-wide Numbering Plan

UNDER operator toll dialing, it is proposed not to increase the number of digits that a customer must dial on a local call merely because of the introduction of toll dialing.

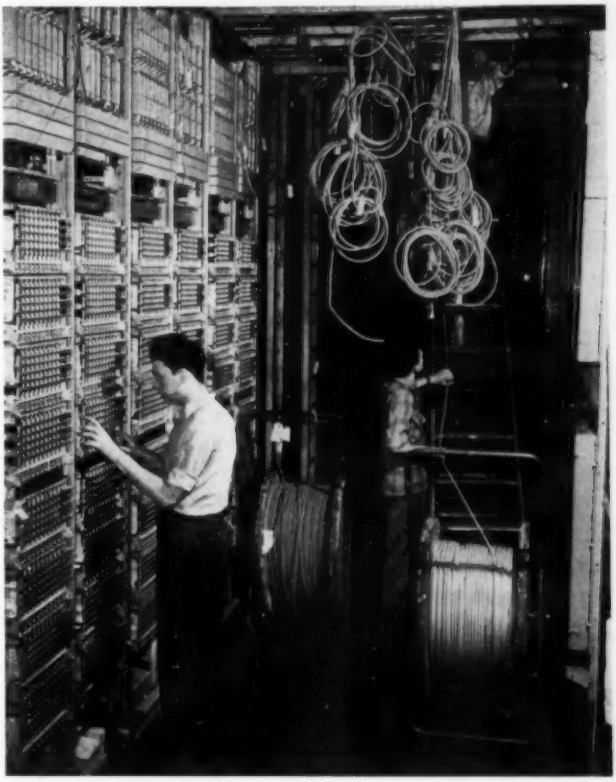
Under this plan, an operator will dial seven digits to reach a number in her own state or numbering-plan area, or ten digits to reach a number in another state or numbering-plan area. An individual designation, called a routing code, must therefore be created, by the selection of a three-digit number, for each central office, for both Bell System and independent companies, in the United States and other adjacent countries included in the operator dialing plans. It is this three-digit code which a calling operator will dial in order to reach a given central office.

Local numbers vary by places from three digits in the smaller towns to seven digits in the larger cities. In many cases, some numbers are four digits and others are five in the same place, and in other places there are five- and six-digit numbers. In some mixed five- and six-digit places, the numbers consist of all numerical digits, while in others they consist of one letter and four or five numerals. Mixed six- and seven-digit places may have two letters and four or five numerals in the number. Seven-digit cities may have three letters and four digits in the local number or two letters and five digits.

All of these arrangements are appropriate for the places in which they exist, but I believe it is clear that a long distance operator in a distant city might well be uncertain what to dial in many cases unless rules are given for her guidance.

Perhaps you can see from this description of the present numbering arrangements that there is a problem of choosing central-office routing codes for operator toll dialing which must be superimposed on the present numbering arrangements.

That problem will be met in this way: The United States and Canada will be divided into 82 numbering-plan areas and, where practical, these areas will include an entire state or province. Each area will include up to approximately 500 central offices, and each office will be assigned a three-digit routing code which does not conflict with any other routing code in its area. Each numbering-plan area will *itself* be reached by means of a three-digit code that does not conflict with any other area code or with any central-office routing code (see page 188).



Installation progresses: frames of crossbar equipment at the left

Thus, each central office in this country and in Canada will be designated by six digits which will distinguish it from every other central office in the two countries. A maximum of ten digits dialed by the originating operator will reach any telephone: three digits for the area code, three digits for the central-office code, and four digits for the called line number. The few exceptions to this ten-digit standard include principally the party-line designations and three-digit central office numbers. To change these would, of course, result in considerable expense and annoyance to telephone customers.

Now let us look at the make-up of the codes themselves. In the Bell System, and in many of the independent telephone companies, "o" (zero) is reserved as a special code by which a customer reaches the operator. "Zero" therefore is not available as the first digit of a routing code. The figure "1" (one) is avoided as a first digit of a code because our equipment is arranged so that an initial pulse of "1" is ineffective. These figures, "o" and "1," are not used in central-office names and there are no letters

on the dials in the "0" and "1" positions. (You may have noticed that in some places the dial number plate has the letter "Z" in the "0" position, but it is not used as part of a central-office name.)

Just because we cannot use them to start a central-office code, however, does not mean we cannot use them in the numbering-plan area codes. With "0" and "1" in the area code, this code is distinguished from all central-office routing codes. Area codes with a "0" in the middle will be assigned to numbering-plan areas which include all of a state. Codes with "1" in the middle will be assigned to numbering plan areas in states which have more than one numbering-plan area.

In the central office, the operator will have a bulletin at her position which shows the numbering-plan area codes for all of the single-area states and for the larger cities in each numbering-plan area of the multi-area states. If she is handling a call to a distant city in a state in which the area code has a "0" in the middle, and the number given by the customer has more than four digits, she will know that she may proceed with the call without reference to the routing operator, since the "0" in the code indicates that it gives access to the entire state.

When she receives a call for a city listed on her bulletin and the area code for that call has a "1" in the middle, she knows that she may proceed with that call but may not go ahead with any other call to points in that state not listed in her bulletin without reference to the routing operator. On calls for which neither the state nor the city is listed on the bulletin, she must of course refer to the routing operator.

Students examining a crossbar switch. The installation of toll dialing equipment in New York has brought about the largest single plant training project in Long Lines's history

Since each call which must be referred to the routing operator is delayed by the additional seconds that must be added to the time required to establish the connection, any plan that can be followed in the assignment of routing codes that makes it unnecessary to refer to the routing operator will improve the quality of the service.

As mentioned earlier, numbering-plan area boundaries will, in general, coincide with state boundaries. In each of the fourteen states which have more than five hundred central offices, including independent company offices, there will be anywhere from two to five numbering-plan areas. In determining the locations of boundaries between numbering-plan areas, a few general rules were followed. All tributaries of a toll center are included in the same area as the toll center. And as much as possible, boundaries within a state are located so as to avoid cutting across heavy toll routes.

Assigning Routing Codes to Central Offices

AT THIS POINT, I should like to speak of the plan followed in assigning routing codes to the central offices within a numbering-plan area.

Please bear in mind, now, that the objective is to establish central-office routing codes that will minimize the number of calls on which the operator must refer to a bulletin or to the routing operator to obtain the route. Also, it would be most advantageous, if possible, to assign all central-office routing codes so that the operator could tell the routing code from the number given by the customer—since the customer gives the number on about 80 percent of the calls placed.

In the seven-digit cities, all central offices have names. In some cities, the first two letters of the office name and a numeral form the office designation—CO(ortlandt)7–1234 in New York City, for example. In others, the first three letters of the office name form the designation—as in Chicago's CEN(tral)–5678. Central-office routing codes are made to conform with the central-office designations in these cities.

In six-digit cities, which have office names, the code is made to correspond with the first three letters of the office name—HOP–1234 to reach HO(pkins)–1234 in Providence, R. I., for instance.

In cities with five-digit numbers (these central offices do not have names) the first two letters of the city name and the first digit of the telephone number are used as the central-office routing code. In Albany, N. Y., by way of example, this would be (AL)3–4567.

Cities with four or less digits will be given three-digit numerical codes which will be based on the first two letters of the city name, as far as this is possible without introducing code conflicts within an area. For Salem, Ore., the central-office routing code would be 725, corresponding to SAL. In some states there are many cities whose names begin with a word such as "San," "Saint" or "New." This makes it impossible to follow the city name rule in many cases.

You will note that, by applying these rules, the operator can tell on a high percentage of calls what the central-office routing code is from the number in the distant city given by

Numbering-plan areas and their codes in the United States and Canada

the customer, and can proceed at once with the handling of the call without reference to bulletin or to the routing operator.

Steps in Handling a Dialed Toll Call

NOW LET ME FOLLOW the steps in the handling of a call under the proposed numbering arrangement.

The customer reaches long distance in the usual manner, and the operator records his call just as she does today. If he gives a seven-digit called number and the call is to a city within her own numbering-plan area, the operator selects a trunk connected with the switching equipment and dials the number, using two or three letters of the office name as required to make seven digits. If the number he gives has less than seven digits, the operator makes up seven digits in one of the ways described in the preceding section.

When the call is to a city in another numbering-plan area, the operator obtains the area code from her position bulletin or, if necessary, from the routing operator, and dials this code plus the seven-digit number.* If the customer does not give the called number, she obtains it from the information operator at the called place and proceeds as described before.

On station-to-station paid calls, she does not remain connected to the circuit after dialing the number, but

NUMBERING-PLAN REQUIREMENTS

* * *

A distinctive telephone number for each telephone in the United States and Canada

*

The minimum number of digits which will provide for

Growth

New services

*

Minimum changes in customers' numbers

Minimum changes in local dialing practice

Least cost for equipment changes

*

Minimum reference to Bulletins and Route Guide

To gain speed-of-service advantage

times the conversation from signals which indicate when the called station has answered. On person-to-person calls, she remains in on the connection to supervise the start of conversation. When the signals indicate that both calling and called stations have hung up, she takes down the connection.

The proposed numbering arrangement must, of course, make provision for the operator to reach other operators at distant toll centers. She may want to reach an information operator to obtain the telephone number on a call placed by name and address, or she may want to ask an assistance operator at a distant point for help in completing a call or in

*A very high percentage of the calls are handled over direct circuits between the calling and called places. In a majority of the toll centers, these direct circuits appear in the multiple before the operator. Because of this, the operator in many cases need not dial the area code to reach the distant office, even though it is in a different numbering-plan area. She merely plugs into the direct circuit and dials the called number.

verifying a busy or don't answer condition. Also, the operator may need to reach a delayed-call operator when a customer reports he is ready to talk on a call which reached his telephone while he was not available.

Each toll center will have assigned to it a three-digit toll office code similar to the local office codes already described. These codes will not conflict with any other toll or local office codes in the numbering-plan area. When the operator wishes to reach an operator at the distant toll office, the toll office code will be used.

Methods of Eliminating Code Conflicts

SINCE the numbering-plan arrangements are necessary to successful operation of the plan, the first step in preparation for its introduction is to assign non-conflicting routing codes to each central office.

In the transition from the present to the proposed numbering, there will be some code conflicts. Such conflicts, however, will be eliminated in some cases by changing central office names, and in others, by using numerical codes not related to the town name.

An example of this is the State of Washington numbering-plan area, where there are three cities which have a central office designated as MAIN. Two of these must be changed. In a few of the smaller cities without central-office names, equipment changes will sometimes need to be made to eliminate conflicts between towns whose names start with the same two letters.

IN CONCLUSION, I should like to note that under the operator toll dialing plan there are numerous equipment and inter-toll trunk layout arrangements which have important functions in achieving the general service improvements.

To mention a few—

All of the important switching points will be equipped with facilities which will complete intermediate switches in a second or two.

Automatic alternative routing will be provided at the switching centers. Calls encountering all circuits busy over the first route will automatically and immediately be offered to other routes, so that in the end only a very few of them will be delayed because there is no idle circuit.

Terminating equipment will select and ring the called number, and through supervisory signals will then indicate to the originating operator when the called station answers or whether it is busy.

I said earlier that operator toll dialing makes for improvement in three ways in the speed with which long distance calls are handled. The numbering arrangements improve the speed with which an operator obtains the routing of a call; the switching facilities at intermediate offices, and the automatic alternative routing, speed the connection at intermediate offices; and the through supervisory signals enable the operator to determine the status of a call at a glance rather than having to wait for a report of its status from the terminating operator.

It is these features which make operator toll dialing "the coming way."

Keeping Our Sights High

Keith S. McHugh

The following paragraphs are from an address, "The All-American Telephone Team," given before the Fiftieth Anniversary Convention of the United States Independent Telephone Association in Chicago on October 15, 1947.—EDITOR.

I BELIEVE that all of us on the telephone job in the next few years are going to have our hands full. The everyday pressure of work will see to that. But we shall want to keep the long view too, and this anniversary is the best kind of occasion for looking well ahead.

Today, as we celebrate the first half century of service of this Association, there are any number of young men and women 20 years old, more or less, who are just starting out in the telephone business. Year by year, the next half-century of progress will be increasingly theirs; and as they grow into the business, and grow with it, and as the new leaders among them prepare to take the helm, they will want to have from us all the help that we can give.

The best way for us to assure them that help, it seems to me, is to keep our own sights high and keep on raising them as we go along. If we do that, and I am sure we will, we can have complete confidence in the job that the young people of today will do when they are called upon to lead the way tomorrow.

NO ONE CAN now foretell the precise extent and character of telephone service 50 years from now. But there are a few general characteristics that most of us cannot help seeing in our mind's eye. We expect to devise better facilities and to make better and more efficient use of them. We see the means of instant communication made ready at hand everywhere, on land, at sea and in the air, in more convenient and more varied forms. We look forward to a service which in speed, in flexibility and in world-wide usage will infinitely surpass anything that we have ever known.

Unless continuous calamity overtakes the world I see no reason to doubt these prospects, provided only that the will to accomplish them energizes everything we do. And here in this country, our All-American telephone team has greater opportunities than are generally to be found elsewhere.

THE PRIVATELY OWNED telephone companies of America have always led all the rest of the world in bringing fast, dependable telephone service to offices, homes, and farms. In doing this a great industry has developed giving useful and interesting employment to hundreds of thousands of people. All this has been possible because the job has been done with American zest and enterprise, and because those charged by the public with the regulation of these companies have had the wisdom over the years to permit them to earn enough to secure the capital needed to expand and improve their services.

The social and political events ahead are hidden from us. But we may take heart and hope in the future when we look at the record of the past. With good will between us, whatever new troubles lie ahead—and we may be sure there will be many—can be met and surmounted, to the end that the people of this nation will continue to have an increasingly finer telephone service and always the finest in the world.

Three Conferences in One Exemplify how the Nations of the World Can Coöperate for Mutual Advantage on the Basis of Mutual Confidence and Understanding

The International Telecommunication Conference of 1947

Bartlett T. Miller

THE THREE international telecommunication conferences which were held concurrently at Atlantic City last summer were of importance to communication companies and agencies throughout the world.

The three were:—

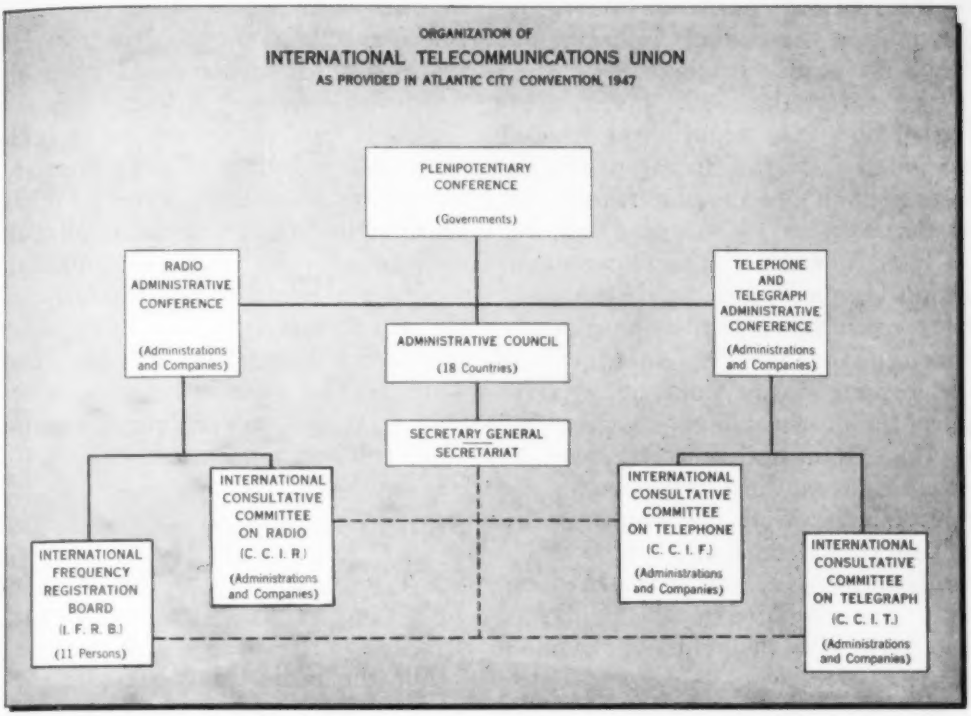
A Plenipotentiary Conference, which was concerned with the International Telecommunications Convention;

An Administrative Conference, which involved the Radio Regulations; and

A High-frequency Broadcasting Conference, which dealt principally with plans for the later discussion of high-frequency broadcasting.

The conferences were held in order that the International Telecommunications Convention, a multi-party treaty, and the International Radio Regulations, which are annexed to the treaty, could be brought up to date. The purpose of the treaty is to provide for solemn agreement among all countries on measures to avoid unnecessary radio interference and to regulate in other respects the conduct of international telegraph and telephone services, whether by wire or by radio. The last Plenipotentiary Conference was held in Madrid in 1932 and the previous Radio Conference in Cairo in 1938.

The frequencies used by all the radio services—ship-to-shore, aeronautical, broadcasting, point-to-point telephone and telegraph, etc.—whether commercial, private or military, and by all the countries of the world, must be harmoniously allocated and assigned, so that the ser-



vices of any one country will not cause interference with those of another country. It can readily be seen, therefore, that the problems are both technical and political.

Many countries have materially expanded their radio services since the 1938 Radio Conference in Cairo, and new techniques have been developed which extend the usable frequency spectrum far above the practical limits of that day. There were, therefore, new technical questions of an international character to be resolved. And, of course, everyone wants more frequency space for more services—more space in the aggregate than there is in the usable part of the electromagnetic spectrum.

THE UNITED STATES DELEGATION was under the jurisdiction of the State Department, and was headed by Charles R. Denny, Jr., of the Federal Communications Commission, as Chairman, and Francis Colt de Wolf, of the State Department, as Vice Chairman. These gentlemen were chosen also as chairman and vice chairman respectively of all three of the international conferences. The United States delegation included executives and experts from the various Federal departments and bureaus and a number of representatives of the telecommunications companies who acted as advisors. Altogether, the United States delegation consisted of about 175 people.

There were more than 400 representatives from 78 foreign countries. These foreign delegations ranged in size from one person to 33 persons. In addition, there were about 60 representatives present on behalf of some 20 international organizations such

as the International Radio Maritime Committee and the International Civil Aviation Organization. The secretariat of the conference, consisting of about 40 people, was headed by a staff from the Bureau of the International Telecommunication Union at Berne.

The International Telecommunication Union is made up of the countries which have signed or have otherwise adhered to the International Telecommunication Convention. The purposes of the Union, as provided in the Atlantic City treaty, are to extend international coöperation in telecommunication, to improve the efficiency of operation of telecommunication services, and to make them as widely available to the public as possible. To this end, the Union aims:

to effect the allocation of the radio frequency spectrum and the registration of radio frequency assignments in such a way as to avoid harmful interference between radio stations of different countries;

to foster the establishment of rates at levels as low as possible consistent with efficient service;

to promote the adoption of measures whereby telecommunication services aid in ensuring the safety of life; and,

to undertake studies, formulate recommendations, and publish information on telecommunication matters for the benefit of all members of the Union.

The activities of the Union have heretofore been supervised by the Swiss Government, but they are from now on to be managed by an administrative council of the Union consisting of 18 member countries. The Union maintains a general secretariat or bureau in Switzerland through which the correspondence of the Union is conducted and which compiles and publishes the appropriate lists of assigned frequencies and other data applicable to international communication services. The Union also provides a Director and a small specialized secretariat for each of three international consultative committees, which deal respectively with problems relating to radio, telephone, and telegraph communication.

Matters Affecting Telephone Service

THE CONFERENCES were organized on a committee basis.

For the radio administrative conference, for instance, there were ten committees. These ten were in turn divided into subcommittees, and these into sub-subcommittees, and so on; each to study one particular phase of the work of the conference.

Of the ten committees of the radio conference, we of the Bell System were particularly concerned in the work of six; and, as our group included five or six men who stayed in Atlantic City for substantially the entire period of the conferences, one of our representatives was assigned to follow the work of each of the important committees and in one or two cases one man covered additional committees. Certain members of our group also followed the work of three of the seven committees of the Plenipotentiary Conference.

Each representative took the responsibility for attending the meetings of his committee and its sub-

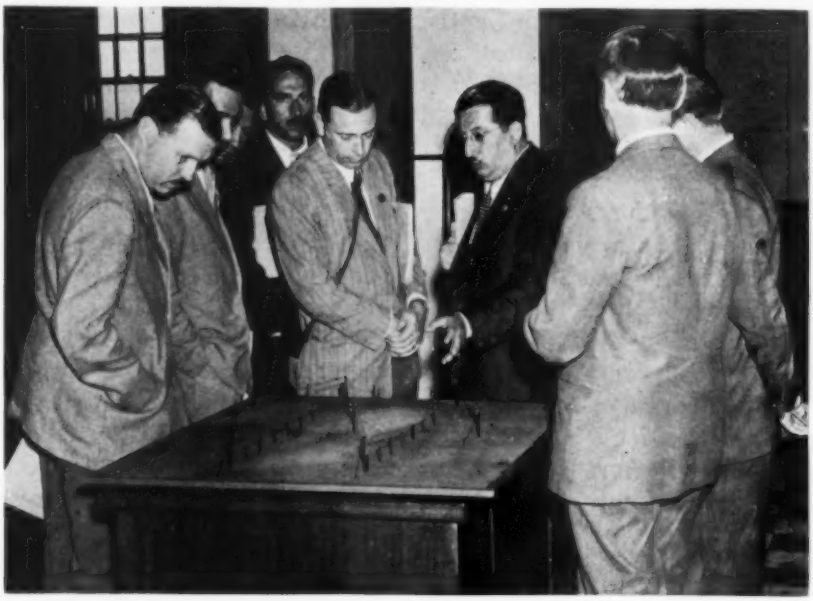
committees, for reading all of the proposals submitted by all of the countries which involved his committee, for analyzing each proposal to consider its effect upon the interests of the United States, and for advising with the United States Delegate on his committee as to what, according to his best judgment, the United States position should be.

Once a week, all the activities of the conferences were summarized briefly and informally, from individual reports which each member of our group made concerning the work with which he was concerned, for the current information of Bell System people in New York.

The Plenipotentiary Conference dealt with such matters as the relationship between the International Telecommunication Union and the United Nations, the way in which the activities of this Union should be handled during the interval between conferences, and the rules dealing with the participation in the periodic conferences by government delegations and by representatives of private operating companies and international organizations.

Among the articles of the convention which are of particular interest to those concerned with telephone service are the articles which relate to the prohibition of discrimination between users of international communication service, the priority which is to be given in the handling of certain government messages, the monetary unit to be used in the settlement of international accounts, and the emphasis on the secrecy of communications and the mutual avoidance of radio interference. The convention also includes a provision that the governments and the operating agencies may conclude special arrangements on telecommunication matters which do not concern the members

Before the main building of the A. T. & T. Company's overseas radio telephone transmitting station at Lawrenceville, N. J.: members of the conference who participated in the first inspection trip, on June 15. Represented in the group are Argentina, Belgium, Burma, China, Denmark, Finland, France, Hungary, Iceland, India, Iran, Italy, The Netherlands, The Netherlands East Indies, New Zealand, Norway, Poland, Portugal, Siam, Turkey, the United Kingdom, and the Union of South Africa—and the Long Lines Department and the Westrex Corporation



Operation of rhombic antennas is explained to a small group of visitors by means of a model layout in the Lawrenceville building

of the Union in general, with a proviso, however, against interference with the operation of radio services of other countries.

By action of the Atlantic City conference, the official languages of the International Telecommunication Union are hereafter to be Chinese, English, French, Russian, and Spanish. The working languages for the conduct of debates and issuance of publications during conferences are English, French, and Spanish.

At Atlantic City, much time was saved for the plenary sessions and larger committees through a system of simultaneous interpretation which enabled each listener to adjust a head set to concurrent interpretation in whichever of these three languages he desired. When, on some occasions, a speaker used Russian, his remarks were also interpreted and could be heard immediately in the other three languages. For the smaller committees, interpreters were available for consecutive repetition of remarks in the several languages.

The Atlantic City Convention is to become effective on January 1, 1949, at which time, for those parties who have ratified it, this Convention will supersede the treaty adopted at Madrid in 1932.

Radio Conference Committees

THE COMMITTEES of the radio conference, the subjects with which they were primarily concerned, the names of the spokesmen for the United States Delegation on the committees, and the names of the members of our Bell System group who coöperated with these spokesmen in the work of certain of these committees, were the following:

1—*Credentials.* This committee reveiwed the credentials presented by the govern-

ment delegations to the Conference to determine whether the scope of the authority given was adequate for the purpose of the Conference. The spokesman for the U. S. delegation was Francis Colt de Wolf, Chief, Telecommunications Division, Department of State.

2—*Steering.* This committee was a policy committee for the conduct of the conference, and consisted of the heads of the government delegations. The spokesmen for the U. S. delegation were the chairman and vice chairman of the delegation, Charles R. Denny, Jr., and Francis Colt de Wolf.

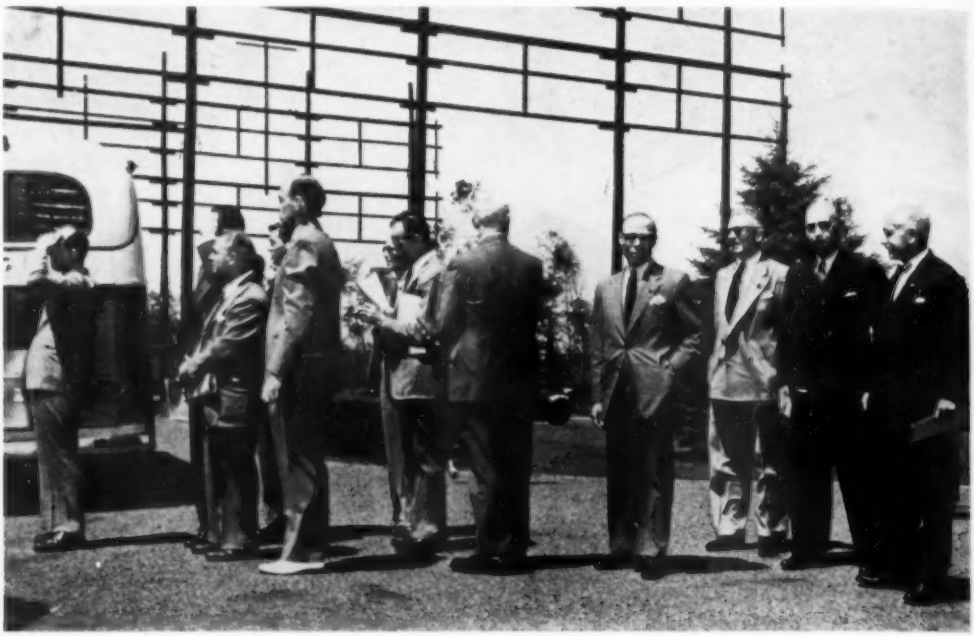
3—*Organization.* The organization committee dealt with the major points in which questions peculiar to radio were involved in the organization of the International Telecommunications Union. (The two principal questions dealt with were the establishment of an International Frequency Registration Board and the revision of the regulations applicable to the International Radio Consultative Committee. This committee is an advisory body which meets about every two years for the purpose of recommending technical standards and guides for the governments and operating agencies and for the International Frequency Registration Board.) The spokesman for the U. S. delegation was Harvey B. Otterman, Telecommunications Division, Department of State. The Bell System representative was Laurens E. Whittemore, O. & E. Department, A. T. & T. Co.

4—*Technical Coördination.* The purpose of this committee was to carry on any necessary coördination of the work of Committees 5, 6 and 7, which were all of a technical nature. The spokesman for the U. S. delegation was Commissioner E. K. Jett, Federal Communications Commission. The Bell System representative was Francis M. Ryan, O. & E. Department, A. T. & T. Co.

5—*Allocation of Frequencies.* This committee was concerned with the revision of the Frequency Allocation Table contained in the International Radio Regulations adopted at Cairo in 1938. Its problem was that of formulating an appropriate allocation of frequency bands for use by various services, such as point-to-point, maritime, aeronautical, broadcasting, amateur, etc. Its work was complicated by the divergent requirements and interests of the countries in various parts of the world and by certain uses of radio frequencies, particularly for navigational purposes and for high-frequency broadcasting, which had come into existence during the war period. The spokesman for the U. S. delegation was Captain Paul D. Miles, Federal Communications Commission. The Bell System representatives were Francis M. Ryan and Richard D. Campbell, O. & E. Department, A. T. & T. Co.

6—*Frequency List.* The Frequency Allocation Table adopted by the conference involves major changes in the frequency bands available to many of the services. It was the task of the Frequency List committee, therefore, to find a way in which the transition could be made from the Cairo allocation to the Atlantic City allocation with a minimum of disruption to international services. It was concluded to establish an international engineering body, known as the Provisional Frequency Board, for the purpose of preparing a new list of the operating frequencies to be used by all international radio stations for which requirements are submitted by the countries of the world. The International Frequency Registration Board is to take the new frequency list, after its approval by a special international radio conference, and thereafter consider whether assignments made by the different countries can be utilized without causing interference with the services for which frequencies have been previously recorded. The spokesman for the U. S. delegation was Captain Gordon L. Caswell, U. S. Navy. The Bell System representative was Douglas D. Donald, Long Lines Department, A. T. & T. Co.

7—*General Technical Regulations.* This committee was charged with the drafting



On the 800-acre rhombic-antenna "farm" at Lawrenceville the visitors are surrounded by antennas which are beamed to many points of the compass

of the definitions of certain technical terms used in the Convention and Regulations and with the formulation of technical standards relative to the band width of radio emissions, the permissible tolerance (i.e., departure of the actual emissions of radio stations from their assigned frequencies), and related questions. It also recommended the utilization of arrangements for monitoring or measuring the frequencies on which the actual operation of radio stations takes place and the reporting of such observations to the International Frequency Registration Board for publication. The spokesman for the U. S. delegation was Dr. J. H. Dellinger, National Bureau of Standards. The Bell System representative was Frederick B. Llewellyn, Bell Telephone Laboratories.

8—*Operating Regulations.* This committee reviewed and revised the radio operating provisions which were included in the Cairo Regulations, particularly those applicable to the maritime service. These provisions related primarily to the establishment of contact with ships and aircraft, to the handling of distress communications, and to the requirements for various classes of radio operators. Both telegraph and telephone communication were involved. The spokesman for the U. S. delegation was Commodore E. M. Webster, Commissioner, Federal Communications Commission. The Bell System representative was Richard D. Campbell, O. & E. Department, A. T. & T. Co.

9—*Drafting.* The drafting committee was most active toward the close of the conference, as its function was to receive the texts of regulations and recommendations adopted by the other committees and, without changing their substance or meaning, to put them in proper form for adoption by the conference. The spokesman for the U. S. delegation was Arthur L. Lebel, Telecommunications Division, Department of State.

10—*Auditing of Report of the International Bureau.* This committee reviewed the report of the financial operations of the

International Bureau prior to approval by the conference. The spokesman for the U. S. delegation was Harvey B. Otterman, Telecommunications Division, Department of State.

Decisions Reached

AMONG THE important decisions applicable to radio were:

Adoption of a new table of allocation of frequency bands to services;

Formulation of plans for the preparation of a revised list of frequency assignments in the high-frequency spectrum for the radio stations of the world based on engineering principles, including arrangements for additional conferences to carry this work forward;

Agreement to establish an International Frequency Registration Board whose function would be to: A), maintain a registry of all international frequency assignments for all the countries; and, B), render advice to the members of the International Telecommunication Union with a view to the operation of the maximum number of radio channels in those portions of the spectrum where international interference may occur;

Agreement that there should be monitoring of such assignments in order to: A), determine the sources of any interference with recognized assignments; and, B), disclose deviations in uses of radio frequencies from those which are set forth in the Atlantic City regulations.

The fact that it was possible to reach agreement on a new Frequency Allocation Table shows that there is world-wide recognition of the necessity of collaboration for the avoidance of interference in the operation of international communication services. The major portion of this table is not to become effective, however, until after there has been an opportunity to review the work of the Provisional Frequency Board in the establishment of the new frequency assignment list. Moreover, the machinery established by the Atlantic City conference for dealing with the problems of radio interference and frequency assignments in the future will have to undergo a period of trial before a definite conclusion as to its effectiveness can be reached.

THE EMPHASIS which has been placed on the necessity of applying the most expert technical knowledge and experience to the solution of these problems through the continuing activity of the International Radio Consultative Committee and the permanent International Frequency Registration Board will, it is hoped, result in making more channels available for international communication and in a reduction of radio interference.

The overseas telephone service of the Bell System requires frequencies in the bands allocated to fixed or point-to-point service, and these bands have been substantially reduced in size in order to make room for expanding aeronautical and broadcasting operations. The employment of improved techniques by all agencies utilizing these bands is therefore particularly important to the point-to-point services.

The frequency allocations made to the maritime services are such as to

offer an oportunity for the further development of marine radio telephone service, although some reorganization of the coastal harbor service may be required as a result of the designation of a specific frequency (2182 kilocycles) for calling and distress purposes in marine telephone operation.

The requirements for radio telephone operators' certificates were brought more fully into line with the operating practices which are made possible through the use of equipment of the modern "push button" type on ships and aircraft.

THE International Telegraph and the International Telephone Regulations, which are annexed to the Madrid Convention, were not revised at the Atlantic City conference. A separate International Administrative Conference is scheduled to be held in 1949 for the purpose of dealing with these regulations.

The International Telegraph Regulations treat largely of operating rules and practices which are the direct concern of the operating agencies which furnish the service, including the communication companies in the United States; and the International Telephone Regulations are at present such as to be applicable only to the European region. The United States Government has heretofore not been a party to either of these sets of Regulations. The Atlantic City Convention provides that the Telegraph and Telephone Regulations as well as the Radio Regulations shall be

Inspecting the new overseas switchboard in the Long Lines headquarters building in New York

In the overseas control room

binding on all members of the International Telecommunications Union unless specific reservation is made to the contrary. The United States delegation at Atlantic City made such a reservation, formally declaring that by signing the Atlantic City Convention the United States did not accept any obligation in respect of the Telegraph Regulations or the Telephone Regulations.

The questions involved in possible adherence by the United States Government to either the Telegraph or the Telephone Regulations are far-reaching and will require further careful study on the part of both the government and the companies.

THE CONFERENCE as a whole lasted for 20 weeks.

The Radio Administrative Conference started on May 15, the Plenipotentiary on July 1, and the High Frequency on August 16. The High Frequency Broadcasting Conference adjourned on September 27, and the Radio and Plenipotentiary Conferences were concluded on October 2 with the signing of the new Radio Regulations and the new Treaty or Convention.

During this time there were issued over 1,600 numbered documents containing proposals, reports of meetings, etc., involving in all about fifteen million pages of mimeographed material.

Atlantic City was chosen as the location for the conferences for the very practical reason that it was the only available place which could accommodate for three or four months their more than 700 members, whose work would be done by a score of committees for which many conference rooms would have to be provided. And it worked out very well

Inspection completed: These visitors have been examining the antennas, atop the Long Lines building, of the New York–Boston radio relay system, which had not then been placed in commercial operation

after one got used to it—although some of the foreign visitors would have been happy if they had had more opportunity to see other parts of the country.

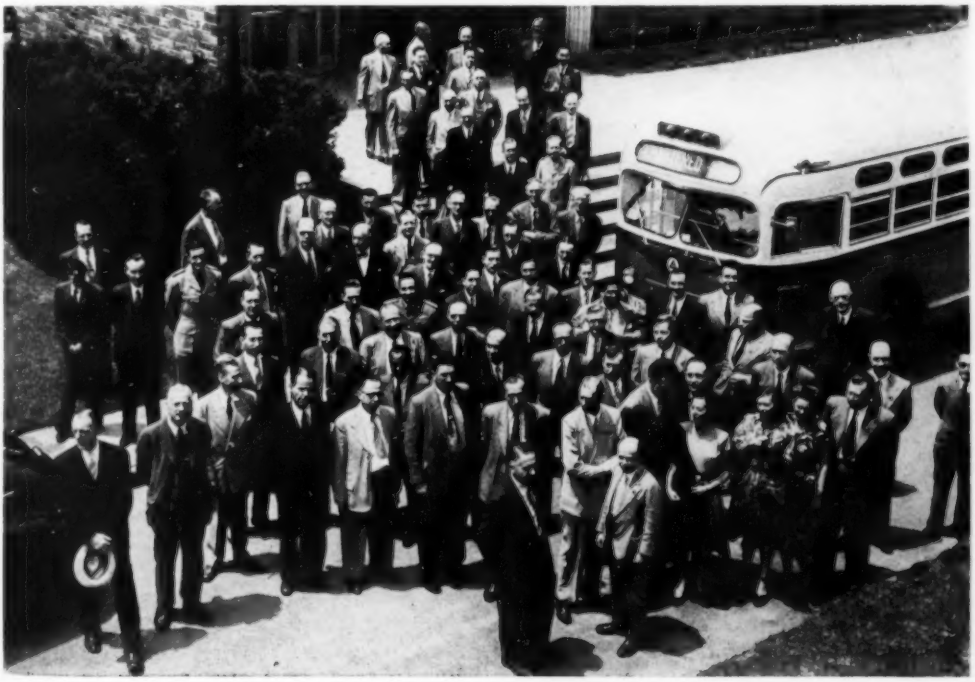
The conference was organized on the basis of a six-day week except on certain week-ends when other activities were planned, and the committee meetings and delegation conferences had to be scheduled at hours when conference rooms were available and when there was no conflict with other important committees on which delegates might be sitting. The work day stretched out to late evenings, therefore, and frequently until after midnight, so that the 20 weeks were a grind for all the participants.

The United States communication companies did what they could to help the foreign delegates enjoy their stay in this country.

A series of week-end trips was arranged by A. T. & T. which took comparatively small groups on visits to Bell System installations in the vicinity: the overseas radio telephone transmitting station of the Long Lines Department at Lawrenceville, N. J., the Long Lines headquarters building at 32 Avenue of the Americas in New York City, and the buildings of the Bell Telephone Laboratories in New York and at Murray Hill, N. J. On one occasion, all of the United States communication companies assisting at Atlantic City joined together and brought over 700 to New York for a week-end of sightseeing. A dinner was given at the Waldorf-Astoria at which President Walter S. Gifford of the A. T. & T. Co. presided on behalf of all the companies. With him at the head table, from commercial organizations, were

David Sarnoff, president of the Radio Corporation of America; A. Warren Norton, then president of Press Wireless Inc.; Joseph L. Egan, president of Western Union Telegraph Company; F. T. Caldwell, president of International Standard Electric Corp., representing Sosthenes Behn, president of the International Telephone and Telegraph Corporation; and R. V. Howley, president of Tropical Radio Telegraph Company.

Our own group endeavored to become acquainted with the members of the foreign delegations, particularly from the countries where A. T. & T. has overseas connections, and we had extremely pleasant evenings with the British, French, Chinese, Russian, Swedish, Portuguese, Danish, Swiss, and other groups. I personally found it very stimulating to be so closely associated with our fine group of Bell System representatives: W. G. Thompson, of the Long Lines Department, who was in many respects the active head of the group; L. E. Whittemore, who handled the administrative side of our office in addition to work on the committees; and F. M. Ryan, R. D. Campbell, D. D. Donald, F. B. Llewellyn, and E. S. Hawley. Their knowledge and energy were frequently of service to the United States chairman as well as to several of the foreign delegates. Someone was technically qualified to assist the United States delegation on almost any question that arose and, individually and as a group, they made appreciable contributions to the work of the conferences.



The Bell Telephone Laboratories at Murray Hill, N. J., were the last stop for conference members before their return to Atlantic City

Opening of New York-Boston Radio Relay System Is Historic Event

THE BELL SYSTEM'S radio relay system between New York and Boston, which hurls telephone conversations and television images along a narrow path of space with energy-renewing boosts from stations on the tops of seven hills en route, was opened for experimental use on November, 13, 1947.

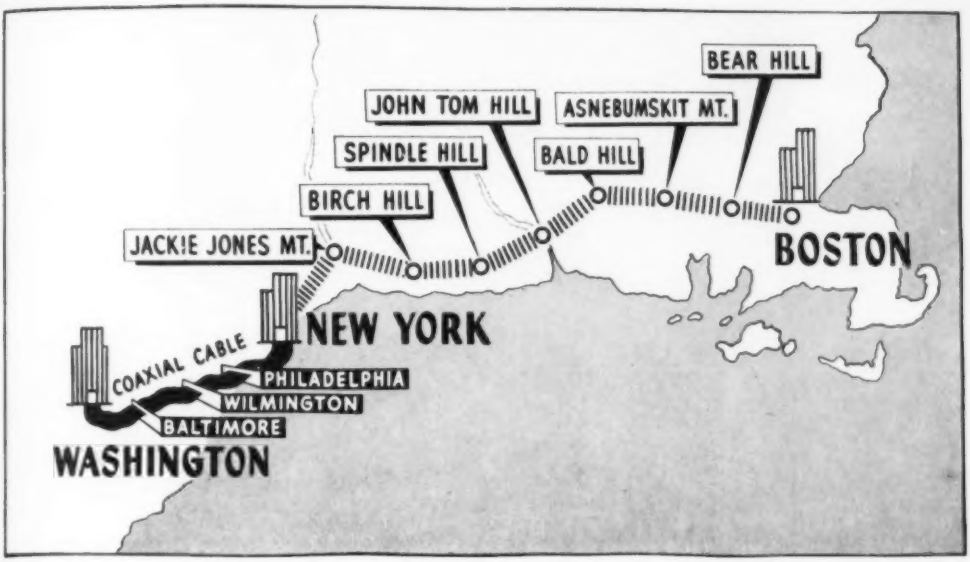
Simultaneous ceremonies in New York, Boston and Washington—including a television program carried on the longest television network in existence—were linked by a circuit combining the new radio relay and the coaxial cable between New York and Washington, D. C. The first telephone call, officially opening the radio relay system, was made by Walter S. Gifford, president of the American Telephone and Telegraph Company, who talked with Joe E. Harrell, president of the New England Telephone and Telegraph Company, in Boston. Speaking from Washington Paul A. Walker, acting chairman of the Federal Communications Commission, and H. Randolph Maddox, president of the Chesapeake and Potomac Telephone Companies, joined the conversation.

As host to representatives of the press and radio and television executives, at the ceremonies in New York, Frank P. Lawrence, vice president of the A. T. & T. Co. in charge of the Long Lines Department, introduced the intercity television broadcast. The program was seen by audiences in all cities along the East Coast having television broadcasting stations. The stations broadcasting the program were: WABD, WCBS, and WNBT in New York; WFIL-TV and WPTZ in Philadelphia; WMAR-TV in Baltimore; WMAL-TV, WNBW, and WTTG in Washington; and WRBG in Schenectady. The television network was about 500 miles long, and made it possible to bring programs to a potential viewing audience of about 25 million people.

Titled "The Story of Seven Hilltops," the television broadcast began in New York, where Mr. Gifford, Carl Whitmore, President of the New York Telephone Company, and Mr. Lawrence participated in the early part of the program. The scene then shifted to Boston, to Mr. Harrell, whose image traveled by radio relay to New York, and beyond to Philadelphia, Baltimore, and Washington by coaxial cable. Next, Mr. Maddox and Mr. Walker, in Washington, joined the program and were seen on television screens in other cities of the network. Tom Shirley, announcer for the Bell System's "Telephone Hour," who was master of ceremonies, concluded the television broadcast in New York.

Following the television broadcast Dr. Ralph Bown, Director of Research at the Bell Telephone Laboratories, conducted a technical demonstration of the radio relay system for the audiences in New York and Boston. Special test films were sent to Boston and back over the microwave beam, and, in a final demonstration, all channels were connected together to transmit a picture twice around the intercity loop for a total distance of nearly 1,000 miles.

As the inaugural program came to an



The Bell System's coaxial cable and radio relay routes between Washington and Boston

end, guests at the New York auditorium were invited to try out the radio relay system themselves. Using a dozen telephones operating simultaneously on the microwave circuits, they talked to colleagues and friends attending the ceremonies at Boston.

In the clarity of the telephone conversations and television images, the seven hilltops had told their story well. And the audience had seen a tremendously intricate job of coordinating conference circuits, sound and video channels, cameras and microphones.

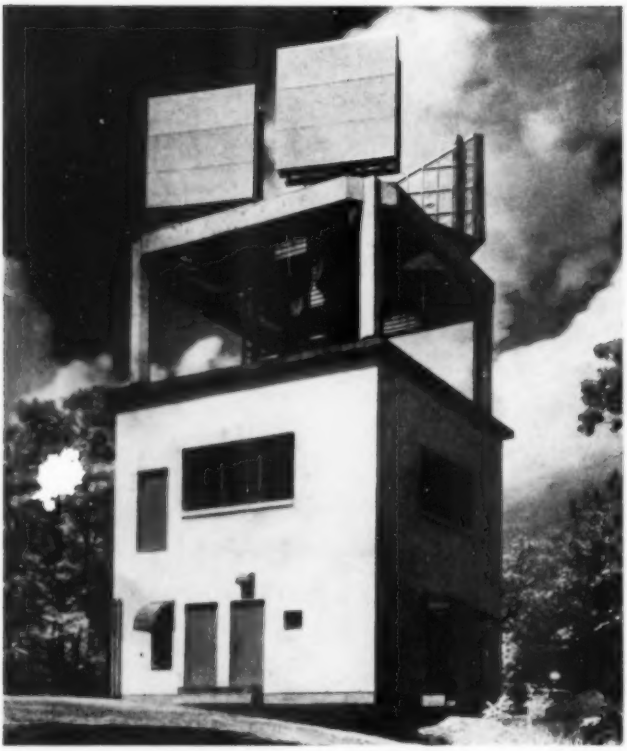
Micro-wave Radio Relay In the Bell System

MICRO-WAVE RADIO RELAY SYSTEMS of the New York-Boston type are basically a means of transmitting large amounts of information—for example, many different conversations—simultaneously over long distances. Using broadband radio beams rather than wire or cable, they provide dependable, high quality communications circuits on a large scale: hundreds, conceivably thousands, of telephone circuits and, if necessary, many television channels. Such circuits can also carry radio programs, teletype, and telegraph.

The New York-Boston system was built to provide a full-scale field trial of radio relay as a part of the Bell System communications network. When development is completed, it is expected to furnish intercity facilities for long distance telephony, television transmission, and other services. Designed to supplement wire or cable lines between cities, the system is another step forward in the Bell System's continuing effort to increase the flexibility and efficiency of its over-all network.

The two terminal points of the radio relay system are the headquarters building of the A. T. & T. Company's Long Lines Department at 32 Avenue of the Americas in New York and, at Boston, the Bowdoin Square building of the New England Telephone and Telegraph Company.

Between terminal points, the micro-wave beam makes eight jumps via seven intermediate radio relay stations spaced about thirty miles apart. To provide the unobstructed view between antennas necessary in micro-wave transmission, the sta-



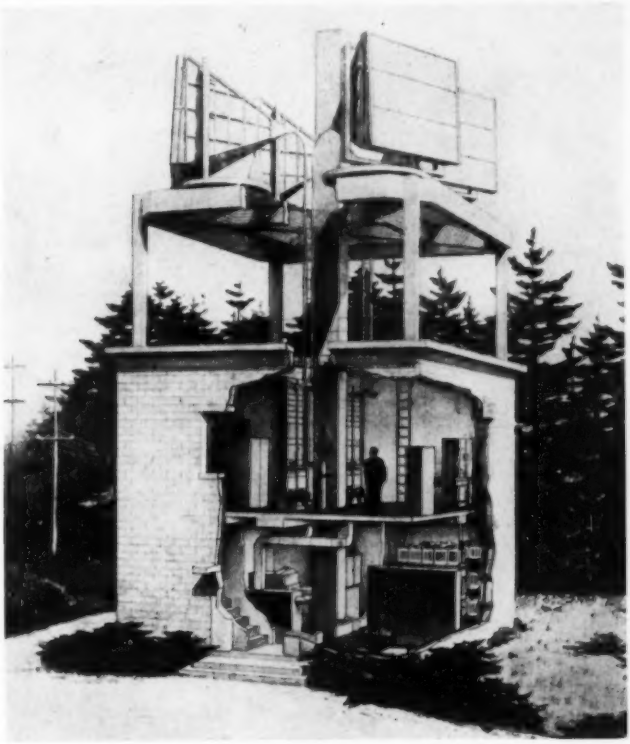
One of the seven intermediate hilltop stations along the route of the Bell System's new radio relay system between New York and Boston. Electro-magnetic lenses in the four horns atop the buildings receive and transmit long distance communications between the two cities. This is the station on Jackie Jones Mountain, near Haverstraw, N. Y.

tions are built on hilltops: Jackie Jones Mountain, five miles west of Haverstraw, N. Y.; Birch Hill, about three miles south of Pawling, N. Y.; Spindle Hill, five miles north of Waterbury, Conn.; John Tom Hill, at Glastonbury, Conn.; Bald Hill, five miles east of Stafford Springs, Conn.; Asnebumskit Mountain, five miles northwest of Worcester, Mass.; and Bear Hill at Waltham, Mass.

On the roof of each radio relay station are four antennas, two facing along the route toward New York, two facing along the route toward Boston. This allows for two-way operation—with one antenna of each pair for transmitting, the other for receiving. The antennas are ten feet square and incorporate a metal lens capable of focussing the micro-wave signals into a beam sharper than that provided by an anti-aircraft searchlight.

At each station there are repeaters, or amplifiers, to keep the signals up to the proper strength as they are relayed along to the next station. Signals are carried from the receiving antenna to the repeaters and out again to the transmitting antenna through hollow metal pipes called wave guides. There are four such pipes at each station: one associated with each of the four antennas.

The first floor of each radio relay tower contains heating and ventilating equipment, as well as an emergency battery and power



Cut-away view of a typical radio relay station between New York and Boston, showing the arrangement of equipment in the building. Emergency power equipment and storage batteries are on the first floor, radio equipment on the second floor, and the special microwave antennas which receive and beam the communication signals are on the roof

generator to give double protection against failure of the power supply.

The initial equipment comprises a regular and a spare circuit in each direction. For operation of these two circuits, frequencies in the range 3700 to 4200 megacycles have been assigned by the Federal Communications Commission. Each circuit carries a signal band width of about five megacycles. Such a band can handle hundreds of telephone conversations, or a television program.

Terminal equipment capable of carrying 240 simultaneous telephone conversations will be installed for experiment next spring, and it is expected that more channels will be added later.

Plans are well under way for a radio relay system to connect New York and Chicago via Philadelphia, and completion is scheduled for 1949. This will contain new developments for better operation and greater carrying capacity—even over the longer distance involved.

Modern Radiotelephone, Teletypewriter, and Telephone Services Are Invaluable Aids in the Apprehension of Criminals and even in the Prevention of Crime

"Arms of the Law"—Police Communications

Richard B. Holt

"At 2 o'clock this morning, slumbering residents in the vicinity of Fifth and Main Streets were awakened by the sharp raps of a nightstick on the sidewalk, as Patrolman J. J. Murphy summoned aid in apprehending a burglar who had . . ."

From a news item of 1920.

"With the capture of four yeggmen in a third floor loft at Chestnut and Elm, early this morning, police believe they have broken up the wave of safe cracking which has terrorized business men in this neighborhood for several months. The reason for the gang's elusiveness, according to police, was their use of 'walkie-talkies' between a look-out posted on the street and other members of the gang in a nearby building. But three police cars, alerted by radio, converged . . ."

From a news item of 1947.

FROM RAP of policeman's nightstick to radio! Here, in dramatic contrast, is a summary of the progress that has taken place in police communications over the past quarter of a century.

Put radio together with the telephone, its older brother, and the teletypewriter, and you have the "arms of the law":—arms which reach into every community and are a major force in helping to provide protection of life and property.

In these days, when criminals take to "walkie-talkies" in executing crimes; and fast cars, good roads, and even the airplane provide means of escape, fast communication is becoming more and more a necessity in police work.

The "arms of the law" must be quick, strong, dependable arms. The job of making them so is a joint responsibility of police and telephone people everywhere.

The role of communications in police work is really two-fold. Its part in the apprehension of criminals

can be readily visualized; but, in addition, a fast and efficient police communication system often acts as a deterrent to crime. A potential criminal may think twice if he knows that the odds are stacked against him by a police force equipped with the latest developments in communications.

How all three types of communications aid in the constant war against crime is an interesting story.

A Pennsylvania State Police patrolman reaches for the radiotelephone with which his patrol car is equipped

LET'S CONSIDER first the radio. While the telephone and teletypewriter provide police with excellent means of fast communication between fixed points, police must be able to reach farther—to the patrol cars and other mobile units which are often responsible for executing the final police job. Here the mobile radiotelephone is invaluable.

Take the case of a recent hold-up at a lonely gas station on the outskirts of one of our large cities.

The attendant was shot and killed by the nervous gunman. A passing motorist, chancing on the scene just as the hold-up man was escaping, called the police from the gas-station telephone and gave an excited story of the murder. Within a few seconds, a radio patrol car on duty near the scene of the crime was dispatched by radio to the spot. Quickly and coolly the radio patrolman questioned the frightened witness: "What make of car was used?" "Did you see the license number?" "Which way did he go?"

Then, without losing a precious minute, the radio car sped in pursuit. While the police driver handled the car, his companion was talking with headquarters over the radiotelephone attached to the dashboard. Quickly a resumé of the crime was reported, and request made to headquarters to dispatch other patrol cars to block all avenues of escape.

In less than an hour from the time of the crime, the fugitive was in police custody and word had been flashed back to headquarters by radiotelephone in order to release police efforts for other assignments.

Reports of similarly spectacular arrests are contained in the files of police throughout the country who

have the advantage of this modern aid to police work.

Early One-Way Experiments

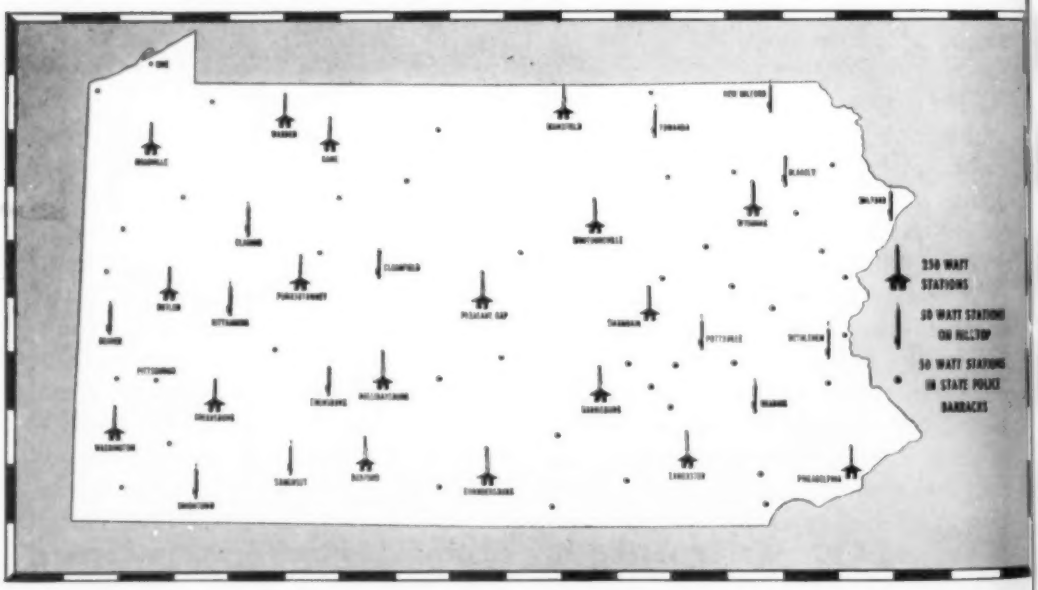
THE STORY of the radiotelephone in police work actually dates back to 1921, when the Detroit Police Department started experiments with one-way radio transmission for dispatching patrol cars. Since that time the technique of the art has been developed to facilitate two-way transmission, enabling the mobile unit to converse with the land station, and even three-way communication, which in addition permits mobile units to talk directly with each other.

For some years the Western Electric Company, as well as other manufacturers, has supplied radiotelephone equipment for private systems owned by police departments.

In 1945, some of the Bell System operating companies began to explore the field of leasing private mobile radiotelephone systems. As in the private-line services regularly offered by the telephone companies—such as telephone, teletypewriter, telegraph—all facilities, both fixed and mobile, are provided and maintained by the telephone company under contract, for the individual use of the customer.

Today, less than three years after the first installation, some 30 state, county, and municipal police agencies are leasing private systems from Bell telephone companies. These systems involve more than 1000 radio-equipped vehicles. Many more systems are being actively considered.

There are many advantages, these customers believe, in leasing such systems from the telephone company rather than establishing privately-



Backbone of the new Pennsylvania State Police radiotelephone system are the 73 fixed radio transmitter-receivers located throughout the state

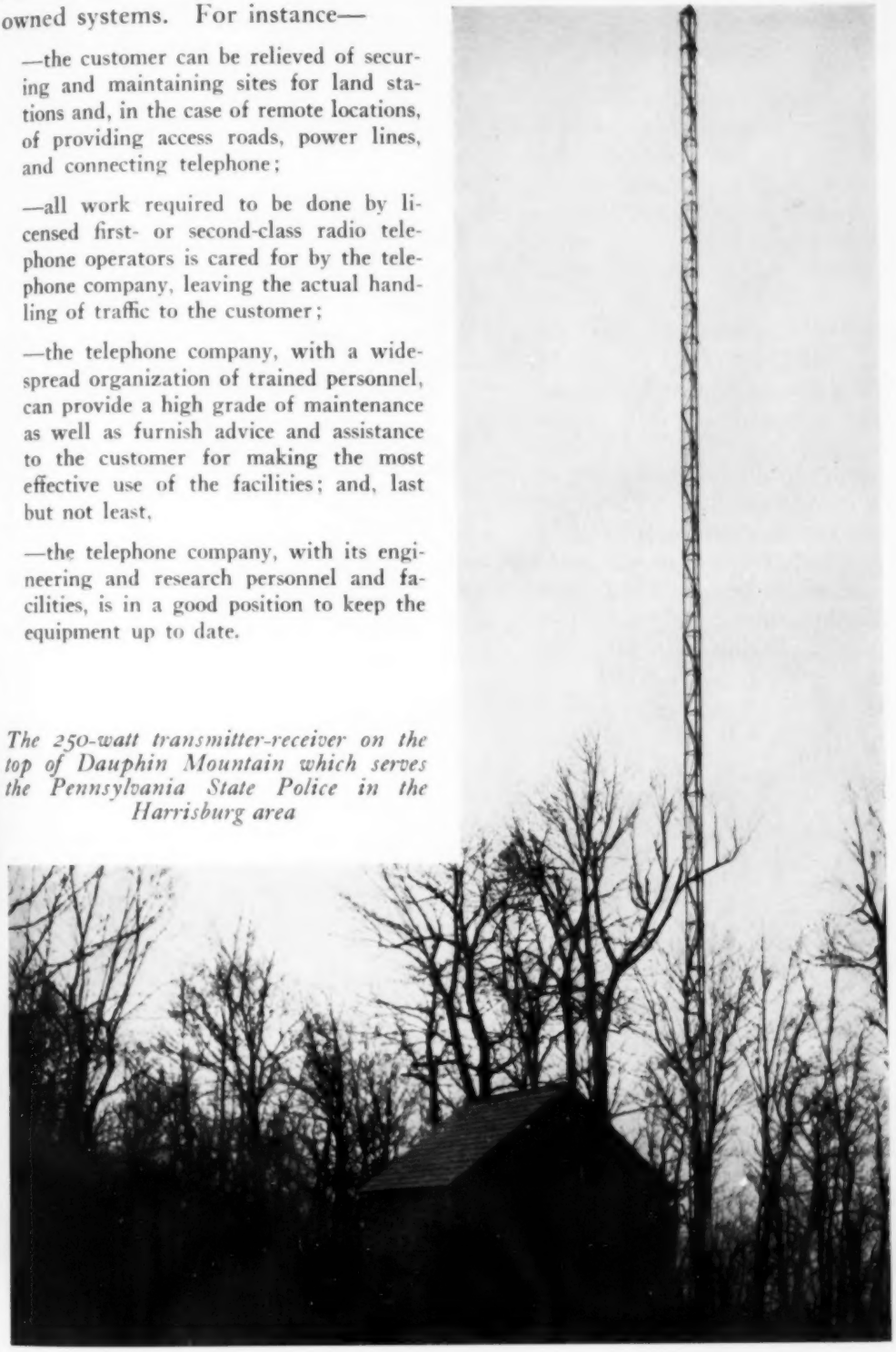
owned systems. For instance—

—the customer can be relieved of securing and maintaining sites for land stations and, in the case of remote locations, of providing access roads, power lines, and connecting telephone;

—all work required to be done by licensed first- or second-class radio telephone operators is cared for by the telephone company, leaving the actual handling of traffic to the customer;

—the telephone company, with a widespread organization of trained personnel, can provide a high grade of maintenance as well as furnish advice and assistance to the customer for making the most effective use of the facilities; and, last but not least,

—the telephone company, with its engineering and research personnel and facilities, is in a good position to keep the equipment up to date.



The 250-watt transmitter-receiver on the top of Dauphin Mountain which serves the Pennsylvania State Police in the Harrisburg area

Pennsylvania's Radio Network

A LARGE private mobile radio system, such as the system recently installed by the Bell Telephone Company of Pennsylvania for the Pennsylvania State Police, presents many problems.

This famous police organization, directed by Col. C. M. Wilhelm, has its headquarters at Harrisburg and is divided into four squadrons. Each of these squadrons is responsible for police activities within a certain geographical area. The squadrons, in turn, are subdivided into troops, with a troop headquarters responsible for activity in each troop area.

The basic problem was to provide a system so designed that each troop headquarters could maintain two-way communication with all mobile units within its area, and also permit one mobile unit to talk with another nearby mobile unit while headquarters "listened in." Sounds easy? Not when you remember Pennsylvania's 45,000 square miles of terrain, with enough hills and valleys to keep a radio engineer's slide rule busy.

Literally thousands of computations had to be made to determine the most advantageous sites for transmitters and receivers before installation could begin. For the network in its entirety provides a total of 73 radiotelephone land stations and more than 250 police cars equipped with two-way sets. Eighteen of the land stations, with 250-watt transmitters, are installed in specially erected brick buildings on mountains or hill tops. The rest, with 50-watt transmitters, are mounted on strategically located poles or in police barracks.

Combined with the radiotelephone system is the State Police teletypewriter network, which had its beginning in 1930. Considerably expanded since then, this network now serves as a link between state police radio dispatchers located in the troop areas, in addition to its major function of handling thousands of messages a day between some 60 state police locations and transmitting bulletins to more than 60 municipal or county police teletypewriter machines.

Should a troop headquarters radio station wish to enlist the aid of police units outside its area, a message is sent over the teletypewriter network to radio dispatchers in other cities. Here, it is broadcast by radiotelephone to local patrol cars in the area —an example of how radio and teletypewriter services can be effectively integrated.

ANOTHER large private radiotelephone system has been engineered recently by the New York Telephone Company for the New York State Police, headed by Supt. John A. Gaffney.

Headquarters of the New York State "troopers" is at Albany, and authority fans out to six troop areas. These troops in turn are divided into zones, which include one police station designated as zone headquarters and certain substations known as 24-hour stations.

Normally, zone headquarters maintains direct two-way communication with all mobile units within its area. However, there are occasions when a troop headquarters station may

The radiotelephone dispatching layout of the Newark, N. J., municipal police. The officer at the right is pointing to the lamps on the wall map, each of which represents a radio-equipped patrol car and indicates its status

wish to coördinate directly the activities of all police cars under its jurisdiction. Hilly terrain makes such complete radio telephone coverage over a broad area from a single transmitter extremely difficult. So, to enable a troop headquarters station to establish two-way communication with all cars in its area, the system includes a network of land-line telephone channels for interconnecting radio transmitters and receivers. Thus the path would be from troop headquarters over the wire network and thence out over radio facilities to the police cars. Return communication from a mobile unit would be picked up by the nearest receiver and fed back over the wire line to headquarters.

These wire lines are versatile, too. When not in use for broad radio coverage, they may be used to provide telephone communication between land stations.

The New York State Police radiotelephone system, like that of Pennsylvania, will provide for communication not only between mobile units and land stations, but also between mobile units. When completed, the system will serve more than 400 police automobiles. In addition, 42 "walkie-talkie" sets will be provided, and two police boats, operating on the St. Lawrence River and Lake Champlain, will be equipped with mobile radio sets. Sixteen portable transmitter-receivers also will be available for emergency use. This radiotelephone system is backed up by a network of private line teletypewriter circuits connecting more than 160 machines throughout the state.

WHILE THERE ARE problems aplenty in designing police radio telephone systems, operating them effectively also is a sizable job. A big-city police radio dispatcher is a busy man.

In Newark, N. J., for instance, he sits behind a large horseshoe-shaped desk. In front of him are a radio microphone and loudspeaker, and at his right a series of buttons, mounted on a panel. These buttons control small lamps mounted on a huge wall map, which shows the entire municipal area. Each lamp represents a radio-equipped patrol car. As a car is dispatched to the scene of an emergency, pushing the proper button lights the lamp indicating that the car is on an assignment.

As other calls come in for police aid in the same area, the dispatcher can tell at a glance the location of the nearest available patrol car and send it to the scene. When patrol cars call back to headquarters to report completion of an assignment, the lamps are extinguished, indicating that the cars are available for other jobs.

Telephone calls for assistance from the public are taken down by four patrolmen seated at a flat desk in the same room. In front of them, recessed in the desk, are rows of keys giving access to lines from the police headquarters telephone switchboard over which the calls are received.

A brief description of the emergency is noted on a slip of paper and passed to the dispatcher. A quick glance at the master map indicates the disposition of available cars and enables the police officer to dispatch the nearest vehicle directly to the scene in a matter of seconds.

These radio patrol cars are well equipped units. When we call "Police" we do not necessarily want just a man in uniform with a gun. Perhaps a serious automobile accident has occurred and people have been injured. The police car, often the first to reach the scene, must be able to give aid quickly and efficiently.

To meet such daily emergencies, some police departments equip their patrol cars with items that seem strange when one thinks of police protection in only its limited sense. A list of standard equipment might include, for instance, fire extinguisher,

Radio-equipped patrol cars of Newark's police department

first-aid kit, heavy jack, crowbars, axes, safety flares, and even a dog-catcher's net.

STILL ANOTHER FORM of ratiotelephone service is available to police organizations: the telephone companies' regular public offering, mobile telephone service.

This service, first offered at St. Louis in June, 1946, is really an extension of the regular local and toll telephone service, by means of radio, to mobile units. Subscribers to this service have, by means of two-way radio telephone sets installed in their cars, access to any other customer of the Bell System whether served by wire or radio channels.

Police in smaller communities—about 50 of them today—have found this service attractive, especially where the cost of leasing or owning a private system might strain the local budget. This form of mobile service has the further advantage of enabling the public or police officials to communicate directly with patrol cars from any telephone.

The City and the Telephone

DESPITE the importance of radio and teletypewriter, the telephone is still the backbone of police communications. It is the chief link between the public—you and me—and the police. "Call the police" when an emergency occurs is practically synonymous with "telephone."

Telephone arrangements for police must be designed differently from those of the average user. When the frantic householder tries to summon police in the middle of the night as a burglar is forcing open a downstairs window, seconds seem like hours, and delays mean danger. Yet calls from the public are predominantly of this type. We seldom need police assistance except in an emergency.

Recognizing this, police communication officers want plenty of central-office lines ("trunks") so that there will be a minimum number of "busies" when the public calls. They also try to provide sufficient personnel and telephones to answer these calls with an absolute minimum of delay.

What happens at the police end of the line when you call them varies widely. It is one thing in a village police or county sheriff's office, something else again in a St. Louis, or a Boston, or a New York City.

In a typical day in Manhattan, for instance, more than 2000 incoming calls, mostly emergency, are handled over the headquarters "alarm turret," and many of these calls in turn set up a chain reaction involving other calls within the police organization itself.

To illustrate what goes on behind the scenes in a big-city police organization, let's look at the set-up provided by the New York Telephone Company for the New York City police, headed by Commissioner Arthur W. Wallander. Divided as it is into five boroughs and 105 precincts, New York City presents a really complex problem for efficient police coördination.

The police and the telephone company have together worked out a plan whereby all calls for assistance are routed immediately to the police headquarters of the borough in which the call originated. By dialing the operator and asking for "police," a

The alarm turret (right) and administrative switchboard (left background) of the New York City Police Department at headquarters of the Borough of Manhattan

citizen is connected immediately to a special "alarm turret" at borough police headquarters. At 240 Center Street, headquarters for the Borough of Manhattan, for instance, the call would come in over one of 21 trunk lines from a telephone central office to a switchboard connecting with almost 200 telephones and manned by 12 patrolmen.

Here the reassuring voice of a specially trained policeman calms the excited caller, and gets all the information available about the exact location and nature of the emergency.

Thus communication is directly with police officers who can themselves initiate any necessary action. There is no confusion from transfer of calls to other offices, no repetition of lengthy information when seconds may save lives.

What the police telephone attendant does after getting one of these calls depends on the nature of the emergency. Should it be an automobile accident which also results in a fire, he has direct access, over the lines appearing in the alarm turret, to the Fire Department and city hospitals. For other emergencies tie-lines or extension lines to the gas and electric companies and other police units such as Homicide Bureau, Riot Squad, Detective Bureau, Radio Dispatcher or Teletype Room provide immediately available channels for help.

Here, too, are terminated tie-lines or extension lines to all police precincts within the borough limits, so that effective contact with all protective forces can be made by the flick of a key.

While emergency calls are first in importance, they aren't the only calls that police receive. Running a big-city police organization is big business. There are thousands of daily calls other than emergency: detectives calling in to report on assignments, welfare agencies discussing cases, police officials calling headquarters, and similar matters.

In order to leave the "alarm turret" free at all times for emergency use, the administrative business is carried on over a separate switchboard also located at 240 Center Street. This board, with more than 40 lines to the telephone central office and over 270 stations, is connected by tie-lines with the alarm turret. This flexible arrangement permits the transfer of any calls received at the administrative switchboard to the alarm turret quickly when emergency action is needed.

The radiotelephone and teletypewriter room of the Ohio State Highway Patrol district headquarters at Findlay, O.

Telephone access to police protection is not limited to subscribers calling from home or office however, for New York police have spotted over 1700 police call boxes throughout the city. These green boxes with the lettering "Use this telephone to call Police" are unlocked and available to any citizen. Direct lines link them to the nearest police precinct station house.

TAKING LESSONS from experience and trying to anticipate the unforeseen are two of the factors that go into the planning of all police communication arrangements, large and small.

This is true in Newark, N. J., for instance, where police protection for over 400,000 citizens is provided under the supervision of John B. Keenan, Director of Public Safety. At Newark police headquarters, the normal complement of trunk lines to the nearest telephone company central office is supplemented by seven additional lines to another central office on the outskirts of the city. Should some unforeseen disaster "jam" the central office which normally serves the headquarters switchboard, calls can be received over this alternative route. These facilities also provide outgoing service during hours when the regular lines become busy with incoming calls.

Here, as in all well-planned police systems, the emergency nature of the communication is the prime consideration. All facilities—switchboard positions, trunk lines, extension lines, etc.—are provided in sufficient quantity for peak volumes, to assure adequate protection under all conditions.

At the other end of the scale are the communities which are too small to maintain a police headquarters office manned 24 hours a day. For such communities, a special arrangement has been worked out, which

Teletypewriter equipment in the headquarters at Columbus of the Ohio State Highway Patrol, of which Col. George Mingle is superintendent

involves a combination of radio and special reversed-charge toll service.

During hours when the local police office is not open, police protection for the community is usually maintained by one or more patrol cars connected with state or county radio systems. The problem is to provide means for getting requests for emergency police assistance *from* the various towns and small communities throughout the county *to* the radio center in the shortest possible time and at minimum cost.

In such cases, the procedure is something like this. The telephone company operator, upon receiving a call for police assistance, attempts first to complete the call to the local police station. If the station does not answer, the operator completes the call to the state or county radio center. At the radio center a policeman takes down the details of the call and, if necessary, gets in touch by radio with the mobile unit nearest the community where the call originated. Charges for the toll call are billed to the local police agency, not to the citizen placing the call.

Teletypewriter: the Third "Arm"

WHILE the telephone provides contact between the general public and the police, and radio the means whereby mobile units are controlled, there is yet a third link in the chain of police communications. This is the job of spreading alarms quickly over large areas: of coördinating the activities of police units within a city, within a state, and even between states, to produce a smoothly functioning team. This role is filled by the third "arm of the law"—the teletypewriter.

Teletypewriter service provides the medium for transmitting quickly and accurately the detailed information necessary in today's police work.

In addition to "broadcasts" and "alarms," this service is used by police for missing person reports, gun checks, stolen car reports, license checks, and many other matters which play a part in the day-to-day war on crime.

The use of the teletypewriter in police work dates back some twenty years, when a group of towns in Connecticut got together and subscribed for teletypewriter service to coördinate the activities of their separate police agencies. From this small beginning in 1927, the use of this communication medium in police work has grown until today networks of police teletypewriter circuits covering more than 373,000 square miles are protecting more than 54,000,000 citizens.

Among the reasons for the widespread use of teletypewriter service in police work, the outstanding ones are: *speed,* which provides a quick means of closing avenues of escape to criminals; *accuracy,* which minimizes errors in license numbers of stolen vehicles or in the description of wanted persons; and a *written record,* valuable for reference purposes and for establishing the responsibility for police action.

Along the eastern seaboard and extending westward through Ohio, eleven states and the District of Columbia have private line teletypewriter systems linking police units within their boundaries. Private line channels from these systems also reach to state police headquarters in two additional states.

Each state system connects with those of adjacent or nearby states, and also with municipal and county teletypewriter systems within the state, to form a coördinated network —known as the Eastern States Police

Teletypewriters at the headquarters of the New York State Police teletypewriter system, at Albany

Teletypewriter Network. Over these facilities it is possible to flash an alarm in a matter of minutes to almost 1,000 teletypewriter machines throughout the area.

In addition, there are scattered county and municipal teletypewriter systems not directly connected with the Eastern States Network. One of the largest is in Wayne County, Michigan, where some twenty communities are connected by private-line teletypewriter service.

In California there is a state-wide network of over 3,600 miles of private-line teletypewriter circuits connecting more than 90 machines.

Between the Eastern States Network and that in California lies an extensive communication system of more than 100 powerful police-owned radio telegraph stations. These serve as a link between the teletypewriter systems in the east and west, and also are the principal means used for intercommunication among some 1400 police agencies in middle-western states.

All of these facilities have been organized to form what is known as the National Police Communications Network. This well integrated police communication system extends from coast to coast and from border to border. Messages may be sent or received over this vast network without charge—which means that the county sheriff can call in the assistance of police throughout the country, if need be, to apprehend a criminal.

Exchange teletypewriter service (TWX) also is widely used by law enforcement agencies. In some states, TWX serves primarily to supplement the private-line systems in maintaining contact with out-of-the-way police stations. In other states, which do not have private line networks, this service is the chief means of interchanging written communications among major police units. Use of this service is not confined to municipal and state police agencies. The Federal Bureau of Investigation, for instance, has over 50 TWX stations at key locations to coördinate the activities of their alert forces throughout the country.

The Bell System's Share

THE TELEPHONE COMPANIES, because of their specialized knowledge of communications, render valuable assistance in improving police communication arrangements. Many of the companies have assigned men to specialize in police communications, especially in the larger cities, and work constantly with police officers to better their communications facilities.

Keeping one jump ahead of crime calls for constant vigilance and for the use of the best and latest developments in many fields, particularly that of communication. It is a job that presents a continuing challenge to the skill and ingenuity of both police and telephone people, a job that goes forward every day "behind the scenes" and affects the lives of us all.

Forest Fire: What an Unchecked Holocaust Wrought in Maine

Timothy P. Mannix

In the past quarter of a century these pages have more than once chronicled hurricane, sleet storm, flood: the destruction each has caused, the heroic efforts of telephone men and women to keep the lines open, to restore service at the earliest moment possible. Now to the roster of nature's assaults upon the telephone is added another kind: forest fire. Mr. Mannix, who is employee information supervisor of the New England Telephone and Telegraph Company, visited the stricken area in Maine while embers still were smouldering, and, deeply moved by what he saw, wrote for a special edition of Telephone Topics, *the employee magazine, the narrative from which the following paragraphs are taken.*—EDITOR.

FOREST FIRES of awe-inspiring proportions, feeding on drought-stricken timberlands and whipped by 50-mile-an-hour winds, swept uncontrolled through many sections of New England during the latter part of October.

While the loss of lives was comparatively small, the destruction of towns, homes, and valuable forests was on a much larger scale than in any previous disaster.

Where the fires reached their most voracious intensity, nothing was left but scorched earth and scarred timber—except for fireplaces and chimneys, which ironically man had fashioned for fire.

Throughout the raging holocaust, men and women battled gallantly to check the rampaging fires. Their struggle against insurmountable odds was one of courage and heroism. It was a heart-rending exemplification of the indomitable spirit of man fighting to save what it had taken a lifetime to build.

In every fire-swept area, telephone men and women were performing notably on the communications front. As power and light facilities were disrupted, the telephone became the principal medium for communication between fire-fighting, relief, police, and military organizations.

The story of their achievements would require volumes to tell. In this special edition of *Telephone Topics* we attempt to capture their spirit of service in highlight fashion only. While it is a story of Maine, it is meant as a tribute to every telephone man and woman in New England whose response to their public trust was unselfishly exemplified.

Complete devastation and destruction on a wholesale scale were perhaps most graphically portrayed on Mount Desert Island. Here, the fabulous Bar Harbor summer resort saw destruction running up into millions of dollars. As far as the eye could reach on either side of the main arteries leading into the Bar Harbor business district, virtually everything was reduced to rubble . . .

IN THE LATE AFTERNOON of October 23 it became apparent that the fires sweeping

The hot breath of onrushing fire

through the forests surrounding Bar Harbor were beyond control. A fifty-mile gale whipped the furious fires into a raging inferno that resisted every effort of the emergency forces. Gradually every road leading out of the business district was enveloped in a blaze of flame. There was no way out.

Telephone Manager John Conti, Jr., recognizing the severity of the situation, appealed to the Navy and the Coast Guard to send boats to evacuate the people from the town. Nearly 35 boats of all kinds, including two destroyers and the Coast Guard Cutter *Bibb*, were sent.

When the town was completely surrounded by fire except on the ocean side, more than 2,000 people gathered on the municipal pier for evacuation. Only a small portion of them was taken off, however, for the 50-mile gale whipped Frenchman's Bay into such a fury that it was impossible to bring boats to the pier.

When the fire reached two principal points only 400 yards from the central office, the wind veered sharply and unexpectly, and not only was the town saved, but also the lives of the men, women, and children who were trapped between the fire and the sea.

In the Bar Harbor central office, every conceivable effort was being made to maintain communications. With all power and light gone, the central office operated on emergency power and was the sole source of communication available to the people of Bar Harbor.

The walls of flame, less than a quarter of a mile away, were reflected in the windows of the central office and played fantastic tricks on the faces of the operators at the switchboard. The central office was filled with smoke and the heat from the approaching fire was so intense that the fire department was summoned to play streams of water on the outside of the building so that the operators could continue to handle the calls of relief agencies, fire, and police departments, and help to dispatch all fire-fighting units from one spot to another as they made a last-ditch stand before the fire swept them into Frenchman's Bay.

Many of those girls worked 60 or 70

hours, snatching cat naps on cots and eating cold sandwiches. For some of them had no homes to go to, and only food provided by the relief agencies was available on the encircled island.

Some who worked through the night of fire and chaos lost their homes and many did not know where their parents or their children were, but despite the uncertainty of the whereabouts of their immediate families and despite the certain knowledge of the loss of their homes and personal property, they continued to work on at the switchboard.

At Seal Harbor, on the other side of the island, all women and children were evacuated—all the men were fighting the fires. All the women, that is, except two operators, Ruth Donnell and Ada Bowden, at the Seal Harbor central office. With all roads blocked by the fire, the women and children of Seal Harbor were evacuated on the Mission boat "The Sunbeam."

The two Seal Harbor operators continued on the job and served at their switchboard throughout the week, catching a bit of sleep only when it was impossible to go on any longer without it. They were dependent on passing trucks for food, for there was no food available on the island except from relief agencies.

Early on Tuesday they lost their lights and their power, too, and had to use a hand generator for ringing. A kerosene lamp, placed on the switchboard between them, provided the only light for its operation for the next three nights. Plant workers jacked up the switchboard in the hope that they could remove it in the event the fire reached the community. A boat was kept on hand for the evacuation of the two operators.

Throughout the week, the changing wind kept building the tension as the fire moved from one section of the harbor to the other, but never did quite reach the settlement. On a small table behind the

The white line indicates where the fire halted its assault on Bar Harbor

The Bar Harbor central office was filled with smoke as the operators worked tirelessly through a long night of suspense and danger

These operators were the only women permitted to remain in Seal Harbor while fire threatened. A kerosene lamp was their only illumination and a boat tied nearby would have been their only means of escape

girls was a lonely and bedraggled bouquet of flowers, snatched from a roadside garden by the fire chief of Seal Harbor, who took time off during the height of the fire fighting to present them to the operators with the remark, "We would be lost without you. Please keep going."

A few miles away at Northeast Harbor a similar situation existed. Five operators, under the direction of Chief Operator Beatrice Foster, remained at their switchboard positions throughout the week. They, too, were without lights on Tuesday, Wednesday, Thursday, and Friday, but did not lose their ringing power. They used candles, lanterns, flashlights, and kerosene lamps to illuminate the face of the board. Their suitcases were packed and standing in the central office, while at the foot of the outside staircase a fishing boat stood ready to evacuate them if the fire struck Northeast Harbor.

These operators, Viola Murphy, Ruth Wilcox, Glennis Reed, Helen Gillette and Philena Davis, supervised the entire evacuation of the town. On order of the town manager, they sounded the evacuation alarm and then called every telephone to explain the necessity of the evacuation. When the evacuation was completed, they were the only women left at Northeast Harbor.

Wire Chief Sheldon Littlefield and his crew had the narrowest kind of escape

from death. Working along a pole line in Bar Harbor, the fire, which moved with the speed of a race horse, shot across the road in front and back and trapped them. Their five motor vehicles were driven across the face of the fire to safety. They felt lucky.

When the fire threatened West Newfield, 40 miles above Portland, the Plant people jacked up the switchboard in the West Newfield office, put it on a truck, and drove it away.

The fire approached to within seventy-five yards of the central office when the wind, which designed a crazy-quilt pattern in its week-long orgy of destruction, suddenly veered and left the center of the town untouched. The switchboard was quickly put back in service and continued on, although the town was threatened several times again . . .

BIDDEFORD, which had been on the anxious side throughout the week, was close to evacuation on Thursday night when the fire which had roared through Lyman and Waterboro suddenly swerved toward the city. The fire came within 200 yards of Webber Hospital and the patients were just about to be evacuated when the fire was checked.

In the Biddeford central office there was the same terrific tempo that characterized all of the central offices in the fire area. Operators worked continuously without returning to their homes as all relief agencies virtually poured their calls through the central office as they attempted to evacuate families in the vicinity of the approaching fire. One operator answered a call from a woman on an outlying road who had been isolated in a farm house with her two children and had no means of leaving. They were rescued by Red Cross workers sent to the scene by the operator.

As in other affected areas, the central office was the principal means of communication for the police and fire-fighting agencies. Two new sections of switchboard recently cut into service were used to handle all fire, police, and fire-fighting calls as a means of relieving some of the

Scenes like this were typical of what the fire left of parts of Bar Harbor

Once there was a telephone . . .

congestion from the regular positions. Here again operators worked throughout the chaotic Thursday night not knowing of the whereabouts of their families or the safety of their homes. Several of the operators who lived in the outlying districts lost all of their belongings when their homes were destroyed.

While many towns and villages were destroyed there was none more completely obliterated than the township of Brownfield. When the flames swept down from the surrounding hills and through Brownfield, they left behind nothing but one house and a wooden railroad station that was only big enough to have the name of the town written on it. From the vantage point of the bridge leading into the town and looking down the main street as far as the eye could see, there was nothing left but black chimmeys and charred trees. The town was gone—it was a ghost town.

In the center of the town, where once an attractive little green stood, was nothing but scorched earth. In the rear, white slabs of marble that marked the graves of the town dead were black. Every bit of vegetation was gone. Against this blackened background of what was once the gathering place of the townspeople was a wooden billboard—a small one, perhaps six feet by four feet. It was black and gold and white and although everything around it was burned, it retained the same black and white and gold as when it was originally painted—it hadn't been touched by the fire. It was the monument to the World War II dead of Brownfield.

In every city and town and village in the fire-affected areas key people were called on by representatives of the Commercial Department. The Commercial people explained the telephone situation and the plans that had been made for emergency services. In some instances, such as Ellsworth, to which the majority of Bar Harbor people were evacuated, the Commercial Department established an entire communications set-up for the community and after assigning key telephones for all agencies drew up a directory of telephones for the information of all key people.

Damage to telephone plant was comparatively light. A total of 472 working stations and 293 left on premises, as well as three PBXs, were destroyed. Telephone poles destroyed or to be removed totaled 1183 and 65 circuit miles of open wire had to be replaced.

One-half mile of local exchange cable, 100 pairs or less in size, was burned out. While fire swept across seven miles of the Boston-Portland toll cable, only 1550 feet of toll aerial cable had to be replaced. Of the 5½ miles of toll cable serving Bar Harbor that was swept by fire, only 750 feet had to be replaced.

Rain came Wednesday, October 29. It was too late.

Above: All that remained of the Jackson Memorial Cancer Research Laboratory at Bar Harbor

Right: This was once a working telephone line

Below: A telephone operator surveys what is left of her home at Biddeford

The USAF Inaugurates a Facsimile Service to Distribute Weather Charts to All Air Force Fields over Bell System Circuits Forming the Largest Network of Its Kind

Weather Charts by Wire For the Air Force

Harry Jeavons

"WHAT'S THE WEATHER going to be?"

That is the question which has been asked most often since history began.

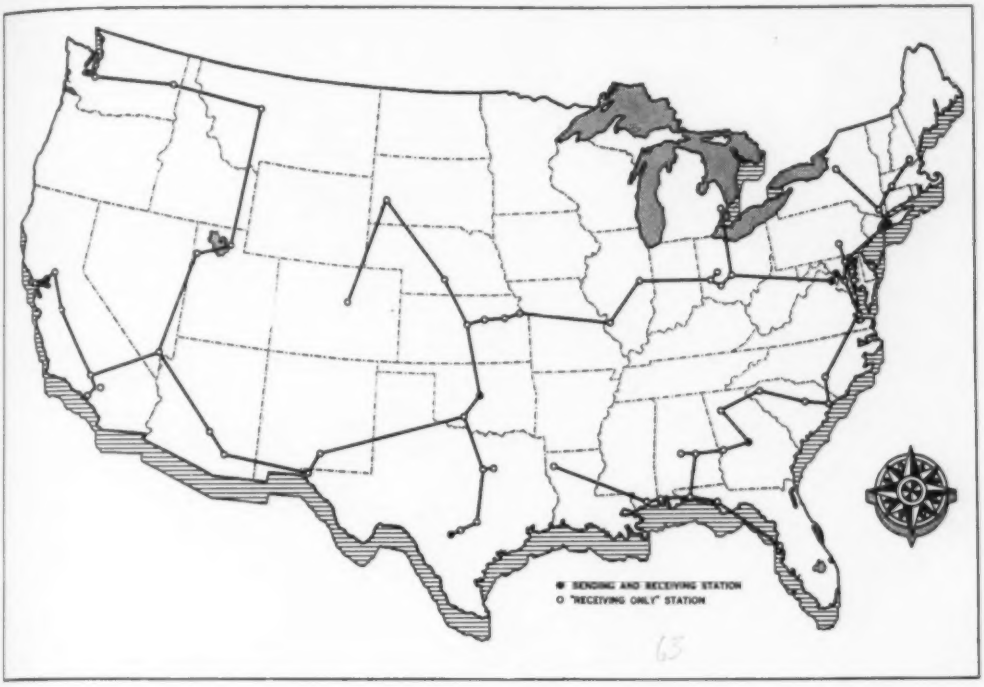
To the pilots of today's airplanes, the question is not one of idle curiosity. They rely on knowledge of what the weather is along the routes they intend to fly and what it will be at their destinations when they expect to arrive. Men fly today with regularity and confidence because they have been told what weather lies ahead.

This accomplishment, this knowledge of specific weather conditions and probable changes all over the world, reflects the effort of countless scores of individuals, of countless thousands of observations over large sections of the globe. It includes the tremendous job of marshaling the forces to collect and plot the data, to analyze the significant factors, and to determine those fundamental conditions which influence the weather at any point. It is a time-consuming and tedious process, but it gives assurance to the pilot of a plane that, short of unforeseen or unpredictable conditions, he should be able to reach his destination at a given time.

To improve the collection and dissemination of weather information and to extend its scope, the Air Weather Service of the USAF (the United States Air Force) recently inaugurated a plan whereby weather charts for all of North America and the adjacent ocean areas are prepared at a central point and distributed by a facsimile process to all Air Force fields in the continental United States.

Transmission requirements of the facsimile services are such as to require high-quality telephone-type facilities, which the Bell System is able to provide.

The facilities now being furnished for the USAF consist of four separate networks of telephotograph (fac-

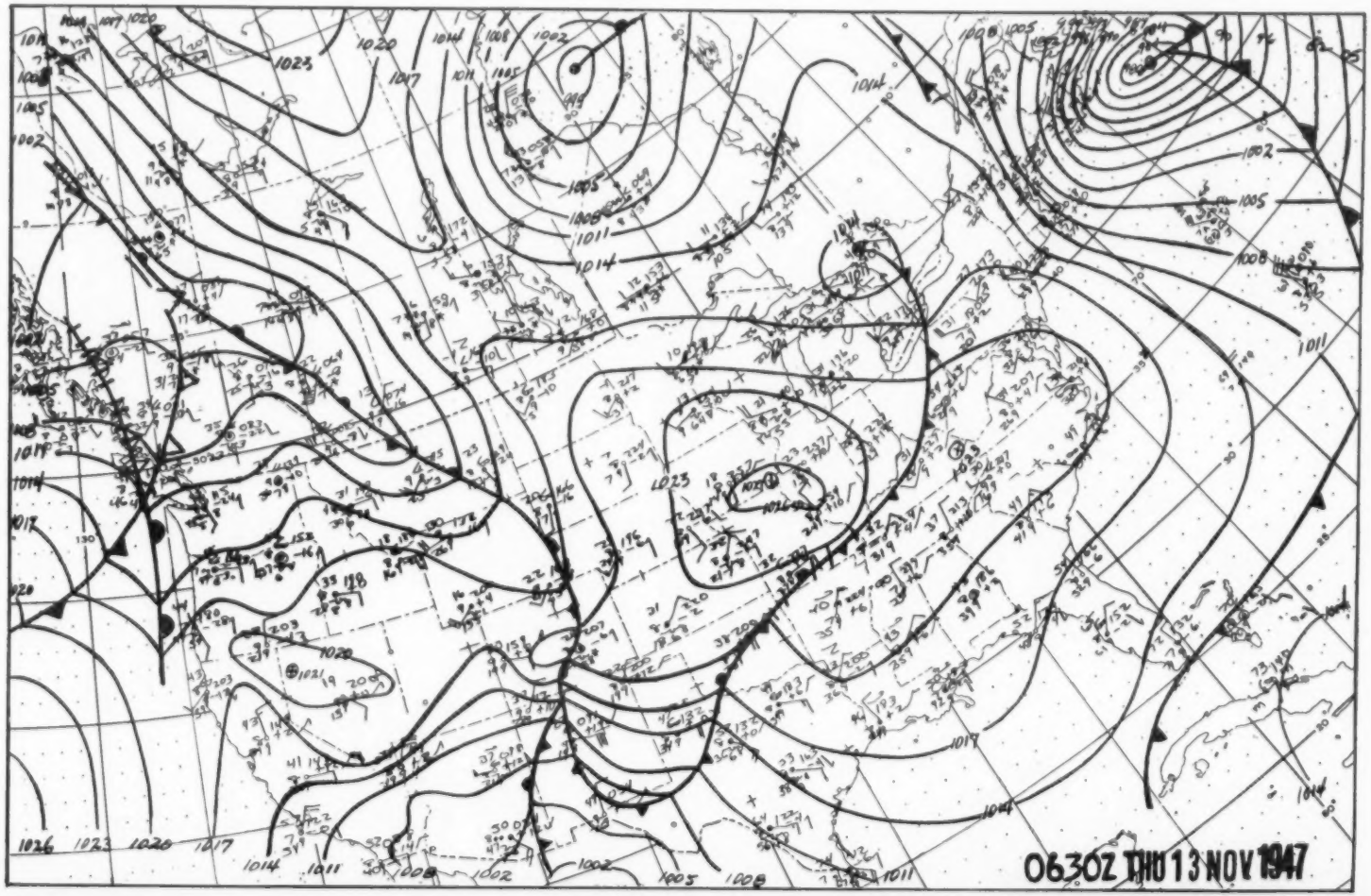


The Air Force Weather Map facsimile network provided by the Long Lines Department serves air fields and bases throughout the country

simile) transmission channels. These networks connect nearly 100 Air Force fields throughout the entire United States. The networks can be interconnected so that one sending station may transmit to all receiving stations. At present, the primary sending stations are located at the WBAN Analysis Center (Weather Bureau, Army, Navy) in the Weather Bureau Building, Washington, D. C., and the Air Force Weather Central in the Pentagon Building across the river in Arlington, Va. Secondary transmitting stations, at which more detailed weather information is plotted and analyzed and may be transmitted within its own regional territory, are located as follows: *Northeastern Section,* Mitchell Field, L. I.; *Southeastern Section,* Warner Robins (Macon), Ga.; *Central Section,* San Antonio, Tex., and Oklahoma City, Okla.; *Pacific Section,* Fairfield-Suisun (Sacramento), Calif.

Approximately 15,000 miles of circuits are employed in furnishing the facsimile network, and in its entirety this system represents the largest of its kind ever attempted.

The Long Lines Department, which is responsible for providing most of this nation-wide network, handled the Bell System arrangements with the USAF. Nearly all of the System's operating companies, and some independent connecting companies, also participated in furnishing the service by providing sections of the inter-city wire facilities, local



Original copy as prepared for transmission over the facsimile network, giving a general surface analysis based on observations at 11:30 A.M., Eastern Standard Time (6:30 A.M. Greenwich Time) on November 13, 1947

Original copy as prepared for transmission over the facsimile network, giving a general surface analysis based on observations at 11:30 A.M., Eastern Standard Time (6:30 A.M. Greenwich Time) on November 13, 1947

The same map as received, showing dark lines on gray background. These illustrations are reduced in size; both original and received copies are 12 by 18 inches

channels, and some of the personnel required for the installation and maintenance of the service.

What Is Facsimile Transmission?

FACSIMILE TRANSMISSION, speaking generally, is the transmission of signal waves, produced by the scanning of fixed graphic images, which are reproduced at the receiving point in record form without further processing after transmission is completed.

A sheet containing the image is wrapped around a "sending" drum, which is caused both to rotate and to move along its shaft. An "electric eye" scans the image and produces changes in signal level which are transmitted to a distant recording instrument that duplicates the image on a "receiving" drum synchronized with the sending drum.

In the case of the Air Force facsimile installation, recordings are made on a specially prepared paper with a conductive backing by a burning process. A stylus, connected to the output of the recorder amplifier, impresses a high voltage at the stylus point when strong signals are received. The heat from the high voltage burns off a surface coating on the specially prepared paper, thus exposing the dark backing. This produces copy with a background of light gray color while the lines or markings of the original appear in dark gray shades.

Another form of paper is also in use which permits multiple reproduction of received material.

The facsimile process differs from the telephotograph process so familiar in the Bell System in that the former is in general considered as reproducing the original without intervention of a photographic operation and without producing a full range of tones from black to white. Telephotograph transmission is usually considered as utilizing a photographic process and as affording a full range of tones.

Once the basic weather information has been plotted and analyzed in chart form, the fascimile method permits the transmission of the completed chart in about 20 minutes; and this provides the forecasters at individual Air Weather Service stations with comprehensive data from which local and route forecasts can be developed without loss of time and without detailed clerical operations on their part.

The Development of Weather-chart Facsimile Transmission

DURING WORLD WAR II, the Air Forces were faced with the tremendous problem of providing operational units with accurate forecasts of weather conditions over base and target areas under conditions in which time was of utmost importance.

Because of the complexity of air operations, it was essential that commanding officers have accurate forecasts available well ahead of planned operations. Also, because of the large areas involved in both the European and Asiatic theaters, it was essential that forecasts at many points be coördinated. To complicate the problem, comparatively few well-trained meteorologists were available. As additional personnel cannot be trained over night in this field, the Air Weather Service established weather centrals to compile and analyze weather data and to provide briefing officers at each command

post with accurate and up-to-the-minute information so that they could intelligently plan their operations.

Various methods were tried for transmitting the information, and the most successful proved to be a system of briefing charts which defined wind and cloud conditions that might be encountered over the base and target areas. This information was plotted on a map in a series of heavy lines—which appeared to lend itself perfectly to facsimile transmission. After considerable experimentation, a facsimile transmission network was established, and it continued to serve successfully throughout the invasion of France.

This balloon is carrying instruments aloft which will radio their records of upper air conditions to observers on the ground

Hitherto, the transmission of weather information to the forecasters at all domestic Air Force fields had been limited to the use of private line teletypewriter networks of the Air Force and the Department of Commerce through a system of coding the locations of isobars and other lines as passing so many miles east or west of certain fixed reference points. This system, while transmitting complete data, used large amounts of teletypewriter circuit time and required personnel at each air base to decode and redraw a rough copy of the weather chart.

With this experience of successful facsimile operation under war-time conditions, the Air Force was confident that a similar arrangement, operating full time, would make it possible to provide each domestic air base with comprehensive weather information—and require less personnel than the older method of weather map preparation.

In order to iron out the "bugs" and to determine more accurately the potentialities, an experimental facsimile service was established in 1946 which interconnected various Air Force, Navy, and Weather Bureau stations in metropolitan Washington with Langley Field, Va.

The experiment proved the point. In addition, added incentive was provided when during the course of the experiment the Air Force determined that the plan permitted Air Weather

Service to release for overseas service five skilled weather forecasting and plotting specialists at each full-time domestic weather station.

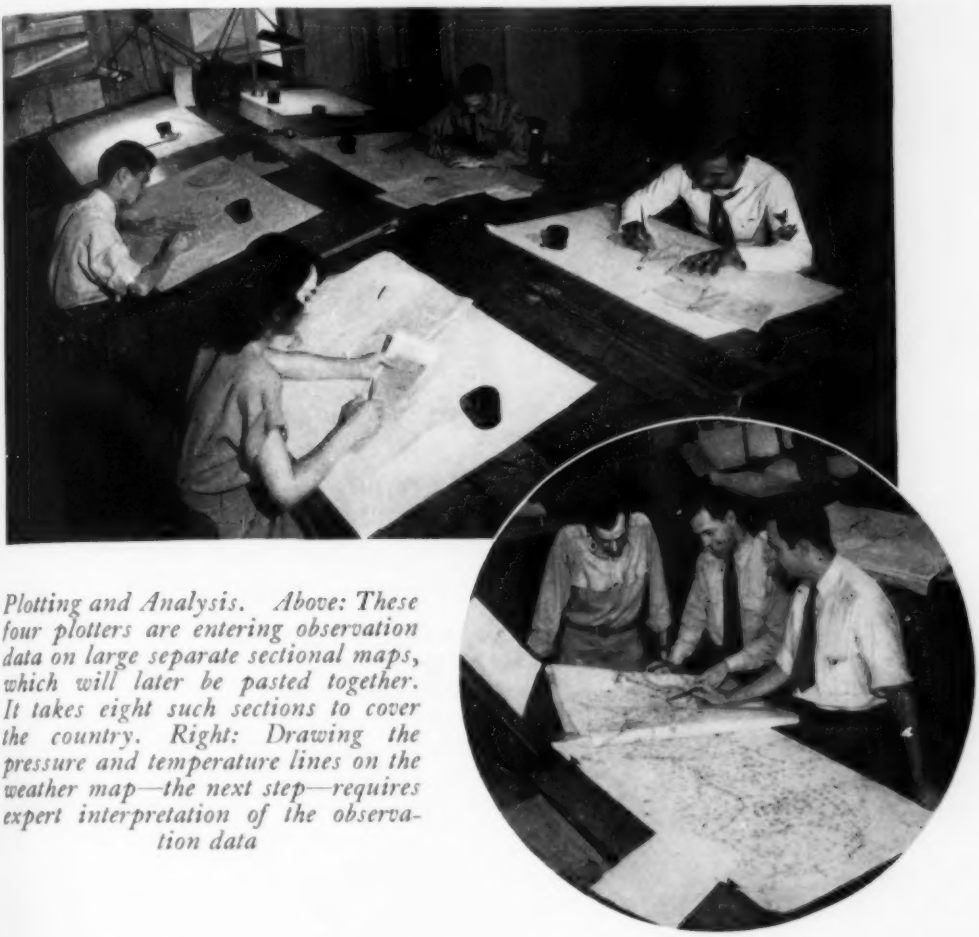
The Weather Analysis Center

IN WASHINGTON, D. C., the Air Force, the Navy, and the Weather Bureau jointly created a master center known as the WBAN Analysis Center. To it all available weather information is brought by teletype.

Information compiled at Weather Bureau stations, Civil Aeronautics Administration observation points, and Naval Aerological and Air Weather stations, as well as weather information obtained through international exchange agreements with foreign governments, is all concentrated at WBAN. Private-line teletypewriter networks of the Airways and Air Communications Service (the operating communications agency for the Air Force), the Civil Aeronautics Administration, the Weather Bureau, and other communication channels, are used at WBAN to receive readings of their multitude of instruments from weather observers in all parts of the country. These data are transmitted to Washington in long teletypewriter messages full of numbers and strange symbols which are meaningless to anyone but trained personnel.

While the data come in as a continuous stream, they actually represent a series of weather observations made at specific and precise times throughout the day. Each weather

Reports from observers all over the country flow into the Weather Analysis Center over private-line teletypewriter circuits which terminate in this room. Air Force, Naval, and civilian personnel typify the joint interest of the Military Forces and the Weather Bureau in the undertaking



Plotting and Analysis. Above: These four plotters are entering observation data on large separate sectional maps, which will later be pasted together. It takes eight such sections to cover the country. Right: Drawing the pressure and temperature lines on the weather map—the next step—requires expert interpretation of the observation data

observing station reports its reading in fixed sequence, and in spite of the "short-hand" techniques it may take well over an hour to collect the information from all stations in North America.

As the weather data become available, they are given immediately to a group of plotters in the WBAN Analysis Center whose job it is to enter the data on a large-scale chart so that they may be more comprehensively understood in the later stages of weather analysis. The work is sub-divided among several plotters so that several sections of the country are being plotted at the same time.

As fast as these sections are completed, they are passed to a group of weather analysts. These analysts include some who specialize in the analysis of surface weather conditions, while others concern themselves only with the analysis of upper air conditions. The job of these analysts is to convert the data on the chart sections into those strange, wandering lines, known as isobars, which are familiar to all who have ever attempted to read a weather chart or map and which give the trained fore-

The objective of the whole process is an accurate local forecast by the Air Force weather man at each air field. H. G. Stommel, technical assistant at Weather Analysis Center, is here shown working on a prognostic chart such as is shown on the opposite page which will go out over the facsimile network to assist in this final step

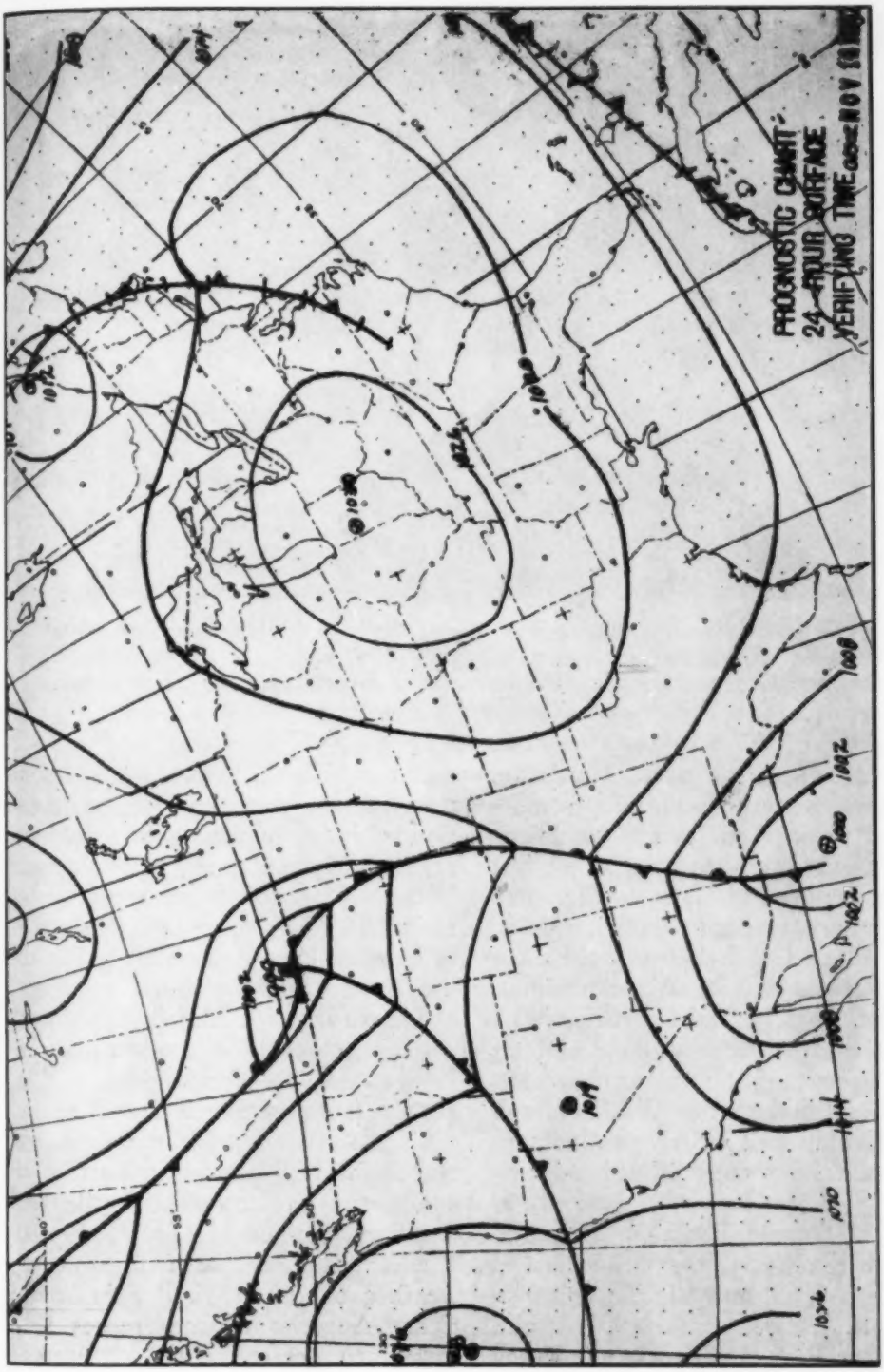
caster an instantaneous picture of the high- and low-pressure areas.

Other information interpreted by the analysts is the location of so-called "fronts"—the boundary areas between large masses of warm and cold air. By comparison with earlier charts, the analyst is able to show the direction of movement of the fronts. Such analyses, particularly of surface weather observations, are no mere matter of routine drafting. Many local conditions—the nature of the surrounding terrain, hills or mountains, rivers or other large bodies of water, other topographical conditions—can influence the recordings at any single point and it takes a trained and skillful analyst to interpret the data correctly.

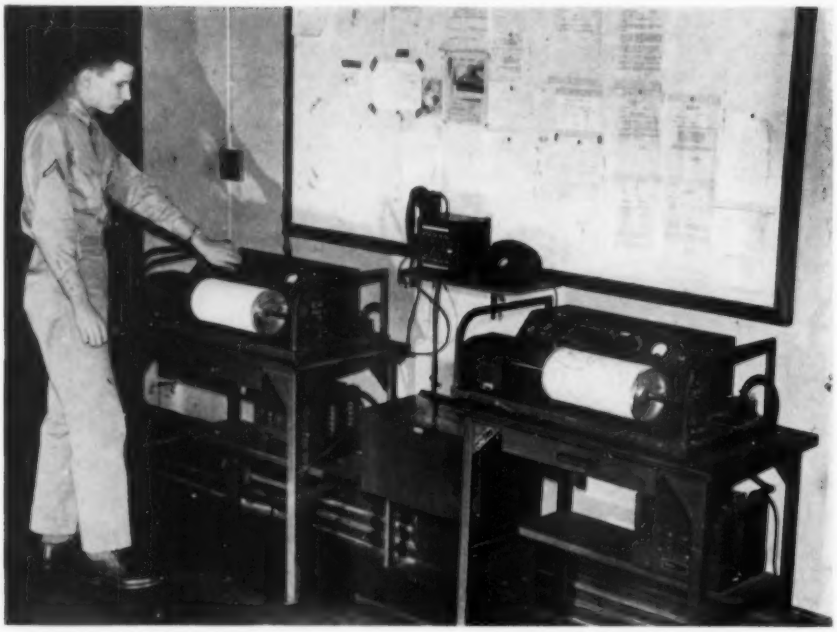
While the plotters and analysts are creating the large detailed chart, based on observations from all sources, another group of plotters is working on a smaller set of charts which will fit the 12″ × 18″ limitations of the facsimile transmitting and receiving equipment. When the plotting is completed on these smaller charts, the isobars and other analysis lines of the larger chart are copied and the final chart is then ready for transmission.

All of the work thus described must be done with a fixed deadline in mind. In general, about an hour and a half is allowed to collect data and to plot and draw up a general surface analysis for the territory of the United States.

Today, with the facsimile network an accomplished fact, about 40 maps or charts are regularly transmitted daily from Washington. For in-



Prognostic chart sent over the facsimile system. It was drawn from data collected at 11:30 A.M. (EST) on November 13, 1947, and represents what a map drawn 24 hours later is expected to show



On the wire: A 12- by 18-inch reduction of the large working map goes on a facsimile "transceiver" for transmission over the Weather Map Network to all Air Force fields and bases in the country. The process takes about 20 minutes. The machine at the right is standby equipment

stance, a general surface weather analysis is transmitted four times daily. General analyses of conditions at various altitudes from 2,000 feet above sea level up to 25,000 feet and higher are transmitted twice daily. Also plotted and disseminated daily are various Upper Air Soundings, Winds Aloft (actual for various centers), and 24- and 48-hour and six day (long range) weather forecasts.

In addition to the WBAN Analysis Center, the USAF continues to maintain its own central headquarters, known as the Air Force Weather Central, in the Pentagon Building. Weather observations are received at this location over the USAF's own network as well as the CAA and Weather Bureau networks; and they also receive all weather charts originated by WBAN. The primary purpose of this station is the preparation of long-range and long-distance oceanic forecasts in the same manner WBAN prepares its weather charts. Its products are employed principally in connection with flights outside of the United States.

Plans for the USAF facsimile network began early in 1946, when the Long Lines Department received a request from the Signal Corps, as the agency of the Army and Air Force responsible for the coördination of engineering and technical details, for a nation-wide network for use by the Air Force and capable of transmitting weather charts or similar information. A series of conferences followed, to determine the characteristics of the transmitting and receiv-

ing equipment the Air Force proposed using, and the various factors influencing the circuit arrangement and control of the proposed network. These conferences created the "know what" which in turn led up to the problems to be met in developing the "know how."

Engineering the Weather Facsimile Network

BECAUSE the network was so large and most points were to be equipped for "receiving-only" service, several engineering problems were introduced into the design and initial set-up. Circuits for facsimile transmission must be "delay equalized"; that is to say, special precautions must be undertaken to insure that all necessary frequencies travel through each branch of the network at the same speed. However, due to the "receiving-only" characteristic of many sections of the network, established methods of measurement necessary to proper adjustment would not work because they depended on a return path exactly similar to the one being measured. Such return paths either did not exist or were very difficult to achieve. The Long Lines Engineering Department, however, designed special apparatus called a "signal shifter" which makes such measurements independent of the return path and thus solved the problem. It promises to simplify delay measurements on all circuits.

This USAF network was so extensive, and its establishment presented such novel problems, that, as equipment and facilities became available, portions of the network were set up and, in coöperation with the Air Force, tests were conducted. In this way, circuit troubles and errors in design were located and corrected before the channels were turned over to the customer.

The major problems of design were practically all resolved by the late summer of 1946, and in August of that year orders were received for the facilities. Work on all phases of the job was immediately stepped up, and in April of 1947 the first of the four sections of the network—the Northeastern section—was turned over to the Airways and Air Communications Service. The second or Central section was turned over in September; the third or Southeastern section in October; and the final or Pacific Coast section in November of 1947.

Since the establishment of the USAF weather chart facsimile transmission system, the merger of the Armed Forces has been consummated and plans for the expansion of the network to include Naval Air Stations are well advanced. Further evidence of the value of the new system to aviation generally is the interest being taken by the commercial air lines, which, having seen it in operation, are enthusiastically inquiring about the possibilities of being hooked into the network.

Twenty-five Years Ago in the BELL TELEPHONE QUARTERLY

Items from Volume II, Number 1, January 1923

A. T. & T. Co. Headquarters

CONSTRUCTION of an addition to the Telephone and Telegraph Building, New York, national headquarters of the Bell System, which has been under way for some time, has been completed and the ground floor was thrown open to the public on November 1. The frontage on Broadway now extends from Dey Street to Fulton Street, the depth being about 275 feet on the former and about 167 feet on the latter. The Telephone and Telegraph Building now occupies a total ground space of 36,000 square feet. It has twenty-six floors.

The Greek style of architecture employed in the old building has been followed in the new structure, Doric columns being used in the lobby and for the first floor exterior, while the exterior columns on the other floors are Ionic. Simplicity and dignity, combined with an impression of enduring strength, are outstanding characteristics.

In no case has utility been sacrificed to artistic effect and the result is a building which is as near perfection from the standpoint of utility as it is from that of beauty. Thirty elevators carry the occupants of the offices to and from their work, while the enlarged lobby prevents congestion, even during the busiest hours of the day. . . .

Besides the headquarters organization of the American Telephone and Telegraph Company and certain departments of the Western Electric Company, the manufacturing branch of the Bell System, the building is occupied by the executive offices of the Western Union Telegraph Company. Its present occupants number about 4,400 but provision has been made for a maximum capacity of 6,000. This will care for the expansion of the telephone organization for some time to come.

From "Notes on Recent Occurrences."

Machine Switching in New York City

THE FIRST machine switching telephone central office in New York City was placed in service on October 14, at midnight, when 1700 lines of the Pennsylvania exchange, which numbers several of the larger metropolitan hotels and department stores among its 10,000 subscribers, were "cut over" from the manual switchboard to the new mechanical equipment.

An intensive campaign of personal instruction to subscribers had been carried on by the New York Telephone Company, with the result that no difficulty was experienced in the use of the dial and the new apparatus is functioning with satisfaction to both the telephone users and the company.

On November 18, approximately 1200 additional lines of the Pennsylvania exchange were transferred to the machine switching equipment, and others are to be added gradually until the entire exchange has been put on a mechanical basis.

The second office to be transferred to the machine switching equipment was Academy, serving one of the uptown residential districts. On December 2 about 4,000 lines served by the manual type of switchboard of this exchange were "cut over," and others are to follow shortly. The next exchange scheduled for transfer to the machine switching equipment is Walker.

The transfer of the Pennsylvania exchange is the first of a series contemplated by the New York Telephone Company. Difficult engineering problems are involved and the manufacture of the intricate apparatus used in connection with the machine switching equipment requires the most painstaking accuracy in every detail.

From "Notes on Recent Occurrences."

A National Telephone Service

WE BELIEVE that the best results for the service and, therefore, for the public will be attained by a relation of confidence and cooperation between the commissions and ourselves. We intend to deserve the confidence of the commissions by the utmost frankness and straightforwardness in our dealings with them, and we hope for a time when the commissions will be kept so well informed continually as to our operations and results and problems and necessities that the great expense of occasional investigations may be saved. We are making systematic efforts to widen the ownership in the Bell System because people will inform themselves and their neighbors about the operations of an institution in which they are partners, and we welcome every opportunity to increase the knowledge of our operations among telephone users. No institution is more publicly owned. Its plant has been built out of savings of the people. It is being extended out of such savings. It is the people's institution more than any other. . .

The interest of the public and our interest are identical in the direction of greatest value which includes greatest extension of the service at fair rates. Sound, efficient and economical regulation involves, therefore, coöperation between the commissions and our companies to produce that result. It involves, when the time comes for a change of rates, a study between them as to what increase or decrease in revenue is indicated, followed by another study on rates with a view to effecting the necessary change in such a way as to make the service available to the greatest number.

I can imagine a commission, in fulfilling its obligations, calling to account a company not sufficiently alert as to its conditions and instructing it that its rates must be increased so that its service to the public may not be in danger. There have been cases where that kind of caution was necessary.

Commission regulation, on the whole, has been satisfactory. We have intended to present our views to them fairly, completely and in a straightforward way. We haven't always reached our standards. Commissions as a rule have manifestly intended to be judicial and fair. Occasionally they have temporized. They have during the past three or four years passed through a very difficult period in which, in order to maintain service of the utilities, rate changes have been advances and not decreases. . . .

We are studying the probable telephone requirements for the next five, ten and fifteen years; we are considering the new capital that will be required to meet the demanded growth; we have men studying the innumerable inventions and technical improvements without which we could not reach our objective. We have to think in big figures,—big figures of labor, material and financial resources, for if we did not, we would be overwhelmed by the increasing public demands.

If we can make you see our objective as we see it, if we can make the picture of the future live in your minds as it does in ours, I am confident that you will see it as an objective of far-reaching national importance, which commands the utmost seriousness on your part, and on our part, and that from that seriousness should come such coöperation as will bring the results which the country demands.

From an address by the late Harry B. Thayer, former president of the American Telephone and Telegraph Company, at the Thirty-fourth Annual Convention of the National Association of Railroad and Utility Commissioners in Detroit on November 15, 1922.

Handling Subscriptions for the A. T. & T. Company's Huge $357,532,600 Convertible Debenture Issue Called for Careful Planning and Efficient Organization

The Biggest Offer Ever

Frederick A. Wiseman

LIKE MILLIONS of other lights twinkling in metropolitan New York, the windows in the office building at 299 Broadway grew brighter as darkness fell over Manhattan. At long work tables on the thirteenth floor, half a hundred women and girls flashed their shiny letter-openers to and fro like tiny sabres. In this group were Mrs. Thompson, whose husband had doubted the wisdom of her taking an office job, and Ann Hobart, who is going back to school again in February. Ann had let it be known that she thought the boss was swell, and she and Mrs. Thompson had agreed with the others that the telephone company was a nice place to work.

A housewife . . . a schoolgirl: two people with not much head for corporate financing, perhaps, but glad —and proud—to be part of the organization that handled the largest piece of financing ever undertaken by a private corporation—A. T. & T.'s recent $357,532,600 convertible debenture issue.

The mammoth offering to stockholders was the latest step in American Telephone and Telegraph's postwar financing for continuing the greatest construction and expansion program in Bell System history.

With the mailing of proxies, prospectuses, and warrants already accomplished, the task of handling subscriptions for the new debentures was itself an undertaking of very large proportions. Like a military operation, it had required months of detailed planning. Organization lines had to be established, and more than 700 people assembled and trained in their duties. Working space had to be procured, and furniture and other equipment moved in. Schedules had to be arranged so that the organization, functioning smoothly and efficiently, could handle, completely and without a hitch, as many as 40,000 pieces of incoming mail a day.

The planning began last spring as part of the program to raise the new capital that must be obtained in order

One of the reviewing groups. Here subscriptions and transactions in rights were thoroughly reviewed and were classified for further handling

to provide for the American people the expanded telephone service they are demanding.

Objectives—and People

GOOD EXPERIENCE had been gained from the convertible debenture issue of December 1946. But for the new offering many improvements were planned. Special attention was to be devoted to the following:

- Improvement in the routine procedures.
- Closer contacts and better relations with brokers and investment dealers handling large transactions in rights and subscriptions for the debentures.
- Improved working conditions for the personnel. (In 1946 the inadequate space available for the work proved to be a tremendous handicap.)
- More and better-qualified supervisory personnel for assignment to the organization.
- More extensive training for temporary employees engaged for the work.

All of the above objectives of the pre-issue planning were achieved in very large measure. From an operational viewpoint, that fact plus the better day-to-day supervision of the work had a marked effect on the success of the issue.

While some experienced telephone personnel from A. T. & T. headquarters at 195 Broadway and from nearby Associated Companies provided a supervisory nucleus, nearly 600 temporary workers had to be recruited from outside sources. Most of them were women. Stenographic experience was necessary in some cases; just common sense in others.

To secure these 600 people, the Treasury Department wrote to the placement bureaus of 29 eastern colleges and universities, from Massachusetts to North Carolina, in the hope of reaching students awaiting the opening of the February semester. In addition, letters were sent to Bell System employees in the metropolitan area, asking them to assist by informing friends and relatives of the temporary positions available. The re-

sponse was very good indeed; Mother Bell found that a lot of people wanted to work for her, even on a short-term basis.

To the Bell System companies in this vicinity went a call for supervisory assistance. They responded generously. Excellent people—people with initiative, intelligence, and marked supervisory ability—were made available to fill important assignments in the security issue organization.

All of this added up to the best organization ever established for an A. T. & T. security issue. When Ann Hobart said her boss was "swell," she was reflecting the impression that seemed to exist in all levels of the organization. The boss, in turn, was saying that he had the best group of people possible for the job to be done. That is the spirit that makes an organization function effectively. Just contemplate this for a moment. In one division with 50 supervisory people, over a period of five weeks only one of the supervisors was absent: an absence of seven hours, equivalent to the loss of one employee day in five years.

Active employment for temporary help was under way by October 1. Some 1,500 persons were interviewed for a variety of jobs, such as clerk, machine operator, typist and stenographer. Two out of every five applicants were hired. Of the 600 new employees, one-third were college-trained, and two-thirds were women. Some, like Mrs. Thompson and Ann Hobart, were housewives and students; some were "between jobs," others just preferred temporary work to permanent jobs. While about a third of the men and women had previously worked for the Bell System, all of them had to learn the details connected with the convertible debenture issue.

This is a section of the communications division where letters of inquiry were answered and irregularities were straightened out by letter or telephone

Then there was the matter of space and tools. Five empty floors at 299 Broadway were leased, and the great trek began.

Into the temporary quarters were moved 46 van loads of furniture and equipment. There were 800 chairs, 450 tables, 225 filing cabinets, 175 desks. There were a hundred typewriters and nearly as many adding, calculating, addressing, and other machines. In addition, there were about 50 clothes racks and three-score miscellaneous items such as postage meters, safes, sorting racks, cash registers—not to mention complete furnishings for recreation rooms. And, of course, there were hundreds of warrant boxes, metal security boxes, desk trays, and the many, many stationery items that go with "paper work." The paper work actually involved tons of paper: yes, 175 tons, of which 25 percent went into the prospectus and the other 75 percent into a variety of printed forms, warrants, letters, envelopes, and other printed material.

Final verification of the subscription papers took place here before the debentures were issued

Telephones were installed. Illumination was checked. Alarm-protected vaults were constructed for the overnight safekeeping of valuable documents. Clocks were installed, coolers for drinking water rented, supply rooms set up. A nurse's office for first-aid treatment was established, and recreation rooms provided restful surroundings for relaxation during lunch and rest periods. And to enliven the atmosphere for employees assigned to the filing job, loudspeakers were installed to bring in popular and classical music.

Ready for Business

WARRANTS were mailed to our then 718,000 stockholders on November 10. By that time, the force had to be ready for its job. A week or more before, training courses had been started. Some 40 girls, most of them college-trained, spent nearly two weeks learning how letters were to be answered (there would be a certain amount of necessary correspondence with stockholders). To assist in manning a counter temporarily established in the lobby at "195" to help shareholders personally with their problems, another group of 40 people, college-trained men, underwent a 10-day period of training. Still another series of training classes was conducted for those whose tasks would be more specialized, such as processing subscriptions. And for

those who needed no such specialized training, one-day orientation sessions provided a glimpse into the Bell System way of life.

The day after the warrants went out, the mail began to roll in:—orders to buy debentures, orders to sell rights, orders to buy debentures and sell excess rights, orders to buy more rights so that more debentures could be purchased, orders to transfer rights to others. As the days went by, sacks of envelopes in ever-increasing amounts came into "299." Some of it came directly from the stockholders, some via the counter at 195 Broadway. Some came from the Company's Treasury offices at Long Lines headquarters in New York; some from Bankers Trust Company, which acted as agent for the sale and purchase of rights for the convenience of stockholders who wished to use its facilities.

Still other mail came from the A. T. & T. Treasury office at the New England Telephone and Telegraph Company's headquarters in Boston. Our company had its beginnings in Boston. At one time, years ago, most of the stockholders were located in New England, and there are a great many there now, as in the past.

About 430,000 pieces of mail were received at "299" during the five-week subscription period. The average daily number was 15,000, the biggest day brought 39,000.

The wheels of the vast production line began moving at the starting point on the thirteenth floor of "299," where the top edges of the

Debentures arrived in the custody section from the City Bank Farmers Trust Company, trustee of the issue, under armed guard

envelopes were whisked off by machinery. Then the women with the shiny letter openers—including Ann and Mrs. Thompson—slit open the two ends of each envelope to make sure none of the contents would be overlooked. The warrant, check (if it was a purchase order), and any other papers were scanned for obvious irregularities and pinned together. If everything was substantially in order, the papers were sent to the reviewing section of the Subscription Division; if not, then to the Communications Division for appropriate communication with the stockholder.

Employees worked in pairs in allotting debentures and enclosing them for mailing to subscribers

The element of human error became evident at the outset. Our stockholders as a group are intelligent people—as was indicated by the fact that the great majority filled out their requests in perfect order—but some of them made mistakes. Considering that warrants and rights are not issued every day in the year and that there are some unavoidable complexities, it would have been surprising if this had not been so. A good many stockholders made out their checks incorrectly, some inclosed the warrant but no check, and vice versa. Two stockholders mistook their warrants for checks and deposited them in their banks. Another executed all three options on her warrant—to buy, to sell, and to transfer her rights—and mailed it in with a signed-in-blank check. Then there were many who thought their receipts were bills, and sent in second payments. More than $25,000 was received by mail in cash—bills, change, and stamps—$2000 of it in one envelope, unregistered.

By and large, transactions went through undelayed. The Communications Division found that cases needing further contacts, by letter or by telephone, were about 10 percent less than for the 1946 convertible debenture issue. This was due primarily to the new simplified warrant—one piece of paper which took the place of three—and the fact that most stockholders had responded to a similar offer the previous year.

Of 12,000 cases needing reply, more than half were answered the day the incoming letter was received, and for all but 1,500 cases replies were made within two days. This is

Frequent conferences were held between supervisors of the A. T. & T. Company and of the Bankers Trust Company to dispose of any questions arising during the handling of transactions in rights for A. T. & T. stockholders

a little faster than the time most of us take with our personal mail. Our stockholders, like the users of telephone service, are entitled to courteous, accurate, complete, and prompt replies to their communications, and that is the way the work of the Communications Division was planned and carried out.

The Method of Operation

THE GREAT MAJORITY of the transactions conducted by mail went straight through without further correspondence. Upon reaching the Subscription Division, the warrants were examined carefully and sorted into various classifications:

Group No. 1 comprised "straight" subscriptions which involved no buying or selling of rights. Stockholders had been granted one right for each share of stock held as of October 31, 1947; six rights were required for the purchase of each $100 convertible debenture. These "even" warrants went straight on through the mill. The processing included grouping into blocks not in excess of 40 subscriptions each, removal of checks, registration (entailing the mailing of a receipt to the subscribing stockholder), preparation of debenture envelopes, and the allotting, enclosing, and mailing of debentures. All papers, of course, underwent frequent verification to insure accuracy.

Group No. 2 comprised subscriptions of stockholders who desired to purchase additional rights to round out their subscriptions. There were more of these in 1947 than in 1946. These subscriptions were grouped in blocks of about 40 each, for convenience in handling, and the number of rights to be purchased for the block determined. These batches of 40 were then processed by a group at "299" from Bankers Trust Company. Bankers Trust completed the purchase of the required number of rights, billed the stockholders, and sent the completed subscriptions along the trail of those in Group No. 1.

Group No. 3 comprised subscriptions of stockholders who desired to sell rights in excess of their subscription needs. These were blocked similarly, sent to the Bankers Trust people for selling and mailing of checks to stockholders, and thereafter re-

entered the subscription line for further processing.

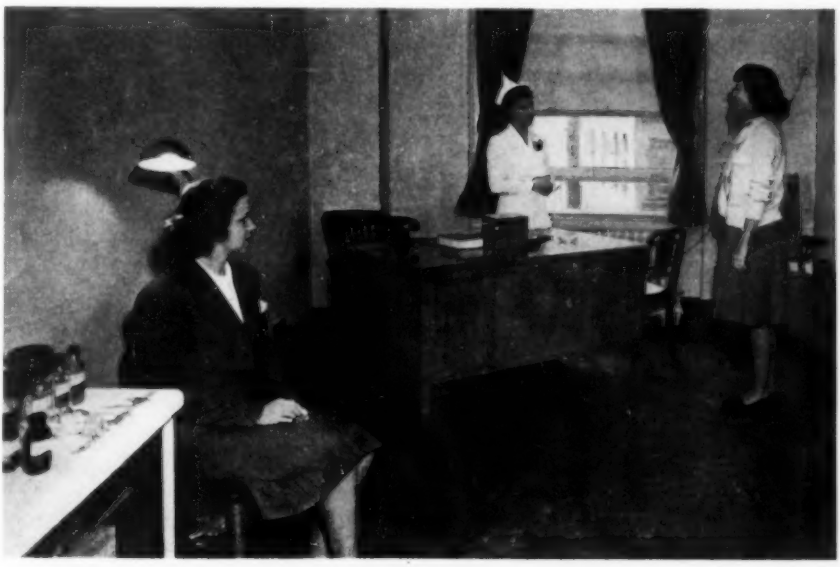
Group No. 4 comprised warrants of stockholders who wished to sell all of their rights without purchasing any debentures. These were blocked and sent to the Bankers Trust people, who sold the rights and mailed checks to the stockholders as in Group 3.

Several handy short-cuts helped to expedite the whole job. One was the blocking procedure. Each batch of 40 warrants was given a number and each of the warrants in the block was stamped by machine with that designation. In the case of subscriptions, to the number of each a suffix, from 01 to 40, was added. Thus, the fourth warrant in Subscription Block 150 would bear the number 15004.

Such a number served not only as the block number and the company's registration number for the subscription; also, since the debentures are negotiable by any bearer and had to be registered for the mails, the number served as the United States Post Office's registered mail number. It appeared on the outside of the mailing envelope, preceded by the letters "AT."

Of course, not all the debentures were delivered by mail. The large subscribers—the banks and brokers—as well as some individuals received delivery of their securities at the counter at 195 Broadway. Delivery of the debentures was an important part of the work: important to the stockholders who used their rights and paid their money; important also to the 300 people assigned to the task of counting, checking and double checking the securities, recording debenture numbers, keeping control records, and seeing to it that each subscriber got just the right securities.

More than 650,000 individual de-



Facilities were provided at 299 Broadway for employees who had need for minor medical attention

Separate facilities were set up in the lobby of the A. T. & T. building at 195 Broadway for security holders who preferred to review and complete their transactions in unhurried comfort

bentures of different amounts were involved:—not mere pieces of paper, but securities—some for $100, others for $10,000, a few for $100,000—each negotiable by bearer like so much paper money. Here indeed was important work for the temporary employees, handling millions and doing so with such precision that there could be no loose ends, nothing out of control. Working at a time when operations were interrupted by two important holidays, Christmas and New Year's, and when the worst storms in many a decade made the daily trip between home and office an adventure, they completed the job ahead of schedule. In fact, deliveries were completed ten days earlier than for the 1946 debenture issue.

The New Warrant

IN THE 1946 issue, warrants were issued as full, or "even," warrants and as fractional warrants. A stockholder owning seven shares of A. T. & T. stock, for example, received a full warrant covering his first six rights, and a fractional warrant for the other one right to make up his seven shares. He also received a form for ordering the purchase or sale of rights or for subscribing.

For the 1947 issue, however, the Treasury Department devised an entirely new form. After an unknown number of drafts and re-drafts, a single sheet of paper was produced far simpler to understand and execute than any of its predecessors. Finan-

cial lingo was conspicuous by its absence; in its place simple, every-day terms were set forth clearly. This new format not only helped the stockholders, but reduced the number of contacts at the lobby counter at 195 Broadway, as well as the number of letters and telephone calls the Communications Division had to write and put through to the stockholders.

A total of $348,418,500 of the $357,532,600 in convertible debentures offered was subscribed for. This is nearly 98 percent of the total—a bigger proportion than was subscribed for in 1946. Subscriptions in the 1947 issue totalled nearly 182,000.

TO GET BACK to the people who did the job—the men and women who joined our organization for six weeks and who for the most part wanted to stay. Like Ann Hobart, they found the telephone company a good place to work. If they were impressed that a big company like A. T. & T. would take the trouble to send them individual letters of welcome, signed by the security issue manager, they were certainly pleased, when they completed their work, to receive thank-you letters personally signed by the treasurer of the company. They had found the working conditions pleasant and enjoyable. They have told us, themselves, that they liked the treatment they received.

It was actually little wonder, then, that when the time came to close the books and go home, a large number of the group wanted to stay on. Each was interviewed, and every effort was made to find a permanent place for them in the Bell System. About 100 of the 600 men and women have been employed in permanent jobs or in further temporary work. And somehow the company felt that the other 500 people would like to help out again with another security issue some day.

THE New Year's ice storm which swept across the country from the Texas Panhandle to lower New England wrought damage to telephone plant of the Southern New England, New York, New Jersey, Pennsylvania, Southern, Ohio, Michigan, Indiana, Illinois, Northwestern and Southwestern Bell companies and the Long Lines Department, and several independent companies. Extent of the damage, greatest in many a year from this cause, is indicated by such Bell System figures as over 125,000 telephones and 6,000 toll circuits put out of service and 15,000 poles down. New Jersey was hardest hit, with 40,000 telephones knocked out and more than a score of central offices without commercial power for varying periods. The Western Electric Company's distributing houses in and near the storm area filled orders for telephone materials to restore service as fast as they were received. Among the innumerable items required were 32,000,000 conductor feet of lead-covered cable; 36,100,000 conductor feet of drop wire; more than a million pounds of copper, copper-steel, and steel wire; 5,600 cross arms; and 72 tons of miscellaneous hardware.

Who's Who & What's What

(Continued from page 179)

vision of the Treasury Department. In the 40 years since he joined the New York and New Jersey Telephone Company, he has devoted himself to accounting, statistical, and methods work; and he carries such kindred responsibilities as assistant treasurer of the Theodore N. Vail Memorial Funds and treasurer of the 195 Broadway Corporation and the Telephone Pioneers of America.

THE VERY PROGRESS of the [communications] art, although it produces serious problems requiring our combined judgment and experience, also suggests solutions. So far, progress in the techniques of international communications and progress in establishing effective procedures for their orderly use have contributed each to the other. I am confident that, with the same spirit of coöperation which has marked the accomplishments of the past, this will continue to be so.

Perhaps the strongest reason why I hold this belief comes out of my judgment of the character of the people who devote their abilities and energies to communications service. The very essence of communications is coöperation. That is fundamental to sending or broadcasting the message or, as we usually say in the telephone business, to getting the message through. In consequence, we whose lives are devoted to communications are so steeped in the habit of coöperation—it is such a familiar thing, so entirely natural to us—that we have every right and disposition to look forward to the ultimate fair and reasonable solution of even the most difficult problems.

It is, in fact, one of the most satisfying experiences of my 43 years in communications work, always to have found other communications men, wherever they might be, sharing this forward-looking view, which is so necessary to the progress of our service. Though we may be born to different languages, I think we have a universal spirit of service we all may be proud of, and through the advance of the art people in all countries have been able to communicate more and more freely with their fellow-citizens however distant, and with the people of other nations over land, over seas, and through the air.

A. T. & T. President Walter S. Gifford to members of the International Telecommunication Conference on July 12.